THE TRANSACTIONS OF THE ROYAL IRISH ACADEMY

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THE

TRANSACTIONS

OF THE

ROYAL IRISH ACADEMY.

VOL. XVIII.

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SCIENCE.

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TRANSACTIONS

OF THE

ROYAL IRISH ACADEMY.

I. *Upon a new Method of investigating the Specific Heats of the Gases. By* JAMES APJOHN, M.D., M.R.I.A., *Professor of Chemistry in the Royal College of Surgeons, Ireland.*

Read 16th March, 1837.

THERE is scarcely a problem within the range of experimental physics, which, in modern times, has attracted so much attention as that which has for its object the determination of the specific heats of what are sometimes, though improperly, called the permanently elastic fluids. It is a problem, also, encompassed by so many difficulties, that the best results hitherto obtained are usually considered but as approximations; and the simple law to which the more recent results would appear to point, that under equal volumes all gases have the same specific heat, is, it is scarcely necessary to remark, far from being universally admitted. The methods of investigation heretofore pursued have been of a direct nature, or have consisted in the estimation of the respective amounts of caloric evolved by equal weights, or equal volumes of the different gases in cooling through the same range of temperature—the results in the latter case being divided by the specific gravities, in order to pass to the relative capacities of equal

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masses. But a given weight of air, in cooling through any number of degrees, will evolve different quantities of caloric, according to the circumstances under which its refrigeration is effected. If it be permitted to shrink as it cools, so that its elasticity may continue constant, it will obviously extricate more heat than if its primitive volume be maintained by being enclosed in, for example, some unyielding envelope; inasmuch as experiment proves that after a gas has cooled down in the latter predicament, a considerable rise of temperature takes place, when upon admitting the atmosphere it is subjected to its original pressure. The specific heat of a gas, therefore, it should be borne in mind, admits of a double interpretation, or is different according as the gas is considered to be of a constant volume or of a constant elasticity.

Now, of the many philosophers who have applied themselves to researches in reference to the specific heats of the æriform fluids, some (as Crawford, Clement, and Desormes, Marcet and De la Rive,) have experimented upon the gases maintained at a constant volume; while others, (as Lavoisier, Laplace, Gay Lussac, Leslie, De la Roche, and Berard, and finally Hayecraft,) upon the same at a constant elasticity; so that for this reason, even if there were no other, their experimental results, and the numerical conclusions thence deduced, do not all admit of immediate comparison.

But though we collate those results alone which are deduced by the same method, a great discordancy will be found to exist between them. The method of Cawford, Clement, and Desormes, and of Marcet and De la Rive, were in principle the same, as all operated on the gases preserved of a constant volume; and, nevertheless, the conclusions at which they have arrived are widely different. Nor is there a closer agreement between the numbers arrived at by those who have essayed the solution of the problem, by determining the quantities of caloric, evolved by the different gases in cooling, under a constant pressure, through the same range of temperature. Some, as Leslie and Hayecraft, have arrived at the law, since so ably advocated by Marcet and De la Rive, that all gases have, under equal volumes, the same capacity for caloric, or what amounts to the same thing, that the specific heats of equal weights are reciprocally proportional to their specific gravities; while others, as Lavoisier and Laplace, Gay Lussac, and, in particular, De la Roche and Berard, have obtained results quite irreconcilable with so simple a view of the subject.

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The most interesting, if not the most recent inquiries in reference to the specific heats of the gases, have been conducted by M. Dulong of Paris. In his memoir upon the subject, published in the Annales De Chimie, (tom. xli. p. 113,) this distinguished philosopher commences with a critique upon the processes of Haycraft, and of Marcet and De la Rive, having for its object to show that the law of "equal specific heats under equal volumes,"* at which they had arrived, however strongly recommended by its simplicity, cannot be considered as unequivocally established by their experiments. It is difficult, indeed, to urge any valid objection against the method of Haycraft. In principle it was the same with that previously practised by De la Roche and Berard, and he, in addition, took the very proper precaution of operating upon gases deprived of all hygrometric moisture. M. Dulong, however, observes, and with truth, that apparently unimportant variations in the manner of conducting the experiments would greatly influence the results, and that Mr. Haycraft has not furnished sufficient details to enable his readers to judge of the amount or direction of the errors by which they were likely to be affected.

The objections to the researches of Marcet and De la Rive are of a much graver nature. These philosophers included the different gases successively in the same globe of glass, and having determined experimentally the times that each thus enclosed took, when exposed to a constant heat, to acquire the same rise of temperature, these times were concluded to be proportional to their specific heats. To obtain, however, the times of heating of equal volumes of the different gases, it is obvious, that we must subtract from those given by experiment the times in which the glass balloon—supposed perfectly exhausted—would undergo the same change of temperature. But owing to the insignificant amount of the mass of the gas compared to that of its envelope, this difference will necessarily always be so small, as to be, in all probability, frequently exceeded by the inevitable errors of observation. Besides, as Dulong observes, and as was shown by him and Petit in their celebrated prize essay on the Laws of Cooling in different Elastic Media, the times of heating of the different gases in the experiments of Marcet and De la Rive, depended not exclusively upon their respective specific heats, but also greatly upon their specific gravities. For these reasons M. Du-

* They are, of course, all supposed to be submitted to the same pressure.

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long does not hesitate to affirm, "that the results of De la Roche and Berard are still those which should inspire most confidence, and that though they cannot be considered as having attained perfect precision, they are amply sufficient for putting beyond all doubt that the various simple and compound gases have not, under the same volume, an equal capacity for heat."

Having disposed of these preliminary animadversions upon the labours of some of his predecessors, M. Dulong proceeds to the explanation of the particulars of a very ingenious method practised by himself, for determining—not the specific heats—either at a constant volume, or under a constant pressure, but the ratio which subsists between these quantities in the case of the different gases. If a be the caloric necessary to be communicated to a given weight of any gas in order to produce in it, maintained of a constant volume, a given increase of temperature, and $a+b$ the caloric necessary to produce the same change of temperature, when the gas is permitted to expand so as to retain its primitive elasticity, $\frac{a+b}{a}=1+\frac{b}{a}$ expresses the ratio in question, and is the quantity at which Dulong, by his method of research, was enabled in the following manner to arrive.

The Newtonian formula for the velocity of sound, viz.

$$v=\sqrt{\frac{gh}{d}}\times(1.+00375t),$$

is long known to give results appreciably less than the truth, but Laplace was the first who pointed out the cause of the discrepancy, and showed that Newton's expression should be multiplied by the square root of the relation between the specific heat of air under a constant volume and a constant pressure, a correction which is at present found to give results in almost perfect accordance with observation. If, therefore, the velocity of sound in atmospherical air be determined experimentally, and that this be divided by the Newtonian expression, the quotient will be $\sqrt{\frac{a+b}{a}}$, or the square root of the relation between its specific heat under a constant volume and a constant pressure; and the same method may obviously be extended to all the gases,* provided we can determine the exact velocity of sound in each.

* The Newtonian expression,

$$v=\sqrt{\frac{gh}{d}(1+,00375t)},$$

is applicable to any gas by substituting for d the s. g. of the gas in relation to mercury.

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This indispensable datum Dulong deduced from certain experiments with a flute-like pipe or tube, blown through by the different gases, from which, by the application of the theory of wind instruments, he was enabled to calculate the length of a single vibration, and the number performed in a given time, for several of the elastic fluids.

The velocities thus obtained were then divided by their values as given by Newton's formula, and the quotients squared necessarily represented, as has been already shown, $1+\frac{b}{a}$, or the relation for each gas between its specific heat under a constant volume and a constant pressure. The following are the results to which he was thus conducted :—

	$1+\frac{b}{a}$	Specific Heat under constant volume.	Specific Heat under constant pressure.	Specific Heat coinc. perse. De la Roche and Berard.
Atmospheric Air.....	1.421	1.000	1.000	1.000
Oxygen	1.415	1.000	1.000	0.976
Hydrogen	1.407	1.000	1.000	0.903
Carbonic Acid.....	1.338	1.245	1.172	1.258
Carbonic Oxide	1.428	1.000	1.000	1.034
Nitrous Oxide.....	1.343	1.227	1.159	1.350
Olefiant Gas	1.240	1.754	1.530	1.553
	(1)	(2)	(3)	(4)

A glance at the first column of this table would appear sufficient to justify the conclusion, that the mixed number which represents the relation in question, is the same for all the simple gases, but that this law does not extend to those of a compound nature, with the exception of carbonic oxide.

If b have the same value for all gases, simple or compound, or, as is indeed extremely probable, if all, in undergoing the same degree of compression, give out the same amount of heat, a, must vary reciprocally as $\frac{b}{a}$, that is the specific heats, under a constant volume, will vary reciprocally, as the fractions in column (1.) Upon this hypothesis, values of a, the specific heat under a constant volume, have been calculated for each gas, that of air being represented by unity, and are set down in column (2). In column (3) we have values of $a+b$, the specific heat, under a constant pressure, which are obtained by multiplying the corresponding numbers, in columns (1) and (2), and dividing all the products by

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1.421, in order that the representative of air should be unity. Column (4) exhibits the specific heats under a constant pressure, as deduced by De la Roche and Berard.

The numbers in column (2) correspond so well with those in column (4), which were experimentally obtained, that Dulong conceives himself entitled to enunciate, as proved, the two following propositions, the first of which he has assumed in his calculations.

1st. That equal volumes of all gases, at the same temperature and pressure, evolve by a given condensation the same amount of caloric.

2nd. That the rise of temperature produced in each gas, by the heat so extricated, is reciprocally proportional to its specific heat, under a constant volume.

At the close of his paper, which was read before the Academy of Sciences, in May, 1828, M. Dulong states, that he was then engaged in researches, in reference to the influence of variations of pressure and temperature, on the specific heats of gases, the results of which he hoped to be shortly able to give to the public in a second memoir, in which it was his intention also to investigate the laws which connect the specific heats of the compound gases with their actual composition. Eight years, however, have now elapsed since this promise was made, and I am sorry to add, (indeed it will be considered matter of general regret,) that it has not as yet been redeemed.

The method of Dulong, just explained, is partly experimental, and partly hypothetical. To the principle on which his experiments were conducted, no possible objection can be urged, and I apprehend that the numbers at which he arrived represent, with considerable precision, the ratios of the specific heats of the gases on which he operated, in the two different predicaments to which allusion has so frequently been made. Doubts, however, may be entertained as to the truth of his hypothetical premiss, that all gases, in virtue of a given compression, evolve the same amount of caloric; and if this be incorrect, his conclusions in reference to the specific heats of the gases under a constant volume, or a constant pressure, must also be erroneous.

These observations are thrown out, with the view of pointing attention to what may be considered as proved, and what assumed, in the paper of Dulong; and of showing, that, even after his elaborate researches, the subject under consideration must still be considered as constituting an open question. At all

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events, assuming such to be the case, I shall, without further preface, proceed to explain the particulars of a new method which I have adopted for comparing the capacities for caloric, of the different æriform fluids.

In a paper which I had the honour of reading in November last, before the Royal Irish Academy, I showed that the formula

$$f'=f''-\frac{48ad}{e}\times\frac{p}{30}$$

expresses the relation between the indications of the wet bulb hygrometer and dew-point; e being the caloric of elasticity of vapour, at the temperature t' of the hygrometer; a, the specific heat of air; $d=t-t'$, the difference between the temperature of air and hygrometer; and f' and f'', the elastic forces of the vapour of water, at the temperatures of the hygrometer and dew-point. If, therefore, the dew-point and temperature of hygrometer be taken in each of the gases, their specific heats become known, for in each case, as may be easily deduced from the expression given above,

$$a^*=(f'-f'')\frac{e}{48d}\times\frac{30}{p}.$$

Such a method, though theoretically exact, is beset with such difficulties, that it may, I think, be considered as practically impossible. The artificial gases, as usually collected, are saturated with moisture—a state in which they are quite unsuited for the necessary experiments; and even though this difficulty were overcome, it would, I conceive, be nearly impossible to determine their dew-point by direct observation.

By recurring, however, to the former equation,

$$f''=f'-\frac{48ad}{e}\times\frac{p}{30},$$

and modifying it, so as to suit a particular case, a much simpler method of investigation is suggested. If the air be supposed perfectly dry, $f''=o$, and

$$a=\frac{ef'}{48d}\times\frac{30}{p},$$

an expression involving no unknown quantity but d, and which will therefore

* a, is here assumed to represent the specific heat under a given volume of the gas, which is the subject of experiment.

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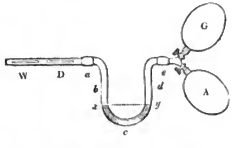
enable us to calculate the specific heat of a gas, when we have observed the stationary temperature to which, when in a state of perfect desiccation, it brings the wet bulb thermometer. The experiments subservient to this method are easily made; and the gases being dry, their specific heats are not affected by the presence of vapours, the influence of which, by the way, we are probably not in a predicament to appreciate with the necessary degree of precision.

The method, therefore, which I have, I believe, been the first to adopt, consists in determining, by experiment, in the case of the several gases deprived of all hygrometric measure, t and t', and consequently $t-t'=d$, and deducing in each instance from these data the value of a, the specific heat.

In order to the determination of d, the following apparatus, and method of experimenting was, after a trial of several others, finally adopted :—



a b c d e is a glass tube, 3-10th of an inch in diameter, and whose vertical arms are each about twenty inches long. Into this inverted syphon oil of vitriol was poured, so as to rise to the height of about two inches in each leg; and to the horizontal portion of each of these there were connected, through the medium of a three-armed copper tube, two bladders, A and G, furnished with stop-cocks, one of which was filled with air, and the other with the gas which was to be the subject of experiment; while to the other extremity of the syphon there was attached, also by a caoutchouc collar, a glass tube, in which were placed the dry and moist thermometers, as represented at D and W. Every thing being thus arranged, an assistant pressed by means of a deal board on the air bladder, by which its contents were forced through the oil of vitriol, where they were deprived of vapour, and over the dry and wet thermometers, producing in the latter a considerable fall of temperature; and the moment that the air bladder was exhausted,

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its stop-cock was rapidly closed, that of the other opened, and the experiment continued by means of pressure similarly applied to the gas. While matters were thus proceeding, I kept my eye, armed with a common lens, steadily fixed on the wet thermometer, and the moment that it acquired a stationary temperature, (which, generally speaking, in consequence of the previous current of dry air, occurred long before the entire of the gas was discharged,) its indication, and that of the dry thermometer, were registered, and the experiment suspended. The residual gas was now passed into a glass jar on the mercurial trough, with a view to subsequent analysis, and both bladders being refilled with atmospherical air, a second experiment was performed precisely as just described.

The values of t and t', obtained in the first experiment, enabled us to calculate, by aid of the equation

$$a = \frac{ef'}{48d} \times \frac{30}{p},$$

the specific heat of the elastic fluid which was made to traverse the apparatus. But this result belonged not to the pure gas, but to a mixture of it with a certain quantity of atmospheric air, which enters the bladder upon the principle of endosmose, and to infer from it the specific heat of the pure gas, which we shall call a', it was necessary to know the amount of air present, and its specific heat. Now the former of these was given by the analysis of the residual gas, as already mentioned, and the latter by the results of the second experiment above recorded, in which both bladders were occupied by air alone.

If a' be the specific heat* of the gas, n the percentage of air, c its specific heat, and a the specific heat of the mixture of air and gas, we will, on the principle that the specific heat of the mixture, multiplied by its volume, is equal to the sum of the products of the respective volumes of air and gas, multiplied by their respective specific heats, have

$$a' \times (100 - n) + nc = a \times 100,$$

an equation from which we deduce

$$a' = a + \frac{(a - c)n}{100 - n}.$$

This is the specific heat of the pure gas in reference to that of air, as determined

* The specific heats spoken of throughout this paper are those under a given volume.

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by the second of the above experiments; and as both air and gas are dry, and must have been, with at least a high degree of probability, proportionally affected by variations of pressure, the precise influence of these, about which, indeed, philosophers are not agreed, do not require to be taken into consideration, nor is there any thing farther necessary for rendering the result thus obtained strictly comparable with those of other experiments, than to reduce it by the Rule of Three to what it would be if the specific heat of air were .267, the number by which it is usually represented in books, at the mean altitude of the barometer. I shall now, before proceeding to the tabular view of my experiments, and their results, exemplify the method of calculation which has been just described.

On the 4th of August, 1835, the following observations were made, first on hydrogen, and subsequently upon air.

	t	t'	d	p
Hydrogen . . .	68	48	20	30.114.
Air	68	43	25	30.114.

By applying to these results the equation $a = \frac{ef'}{48d} \times \frac{30}{p}$, we get

Specific heat of air . . . . . $= .2767 = c.$
Approximate specific heat of gas . $= .409 = a.$

But the gas, upon analysis, was found to contain 5 per cent. of air. Hence the specific heat of the hydrogen supposed pure, as deduced from the equation

$$a' = a + \frac{(a-c)n}{(100-n)},$$

becomes, .4151. And as, .2767 : .4151 :: 2670 : .4005, the specific heat of hydrogen compared to that of air under a pressure of 30, when water is represented by unity, or what amounts to the same, when air is .267.

The following tables include the particulars of the first series of experiments I performed on this interesting subject. In order that they may be perfectly understood, the reader should recollect that t is the temperature of the dry, and t' of the wet thermometer; that $d = t - t'$; that p is the existing pressure, as measured by the barometer; a the specific heat of gas, as deduced from the formula

$$a = \frac{ef'}{48d} \times \frac{30}{p};$$

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a' the same corrected by the formula

$$a' = a + \frac{(a-c)n}{100-n},$$

for the percentage of atmospheric air present; and a'' the specific heat reduced to what it would have been if the corresponding experiment on air had given as result, .267. Table (1) relates to atmospheric air alone, and table (2) to the other gases. In table (3) we have the results stated in table (2) referred to atmospheric air represented both by .267 and by unity.

(1)

	t	t'	d	p	a
June 21.	58.8	38.4	20.4	30.014	.2912
27.	52.7	34.9	17.8	30.225	.2935
July 31.	64.5	41.2	23.3	30.330	.2773
August 1.	67.3	42	25.3	30.140	.2624
4.	68	43	25	30.114	.2767
5.	67	42.4	24.6	30.000	.2768
7.	66	44.7	24.3	30.218	.2657
					.2776

(2)

		t	t'	d	p	a	Air per Cent.	a'	a''	Means.
Azote	June 27.	53.8	35.5	18.3	30.225	.2915		.2915	.2912	.2660
	July 31.	65	41.3	23.7	30.330	.2735		.2735	.2669	
Carbonic Acid	June 21.	60	40	20	30.014	.3135	11.4	.3137	.2876	.2910
	27.	53.8	36.5	17.3	30.225	.3178	12	.3211	.2921	
	July 31.	65.2	42.7	22.5	30.330	.3021	8.2	.3043	.2939	
Carbonic Oxide	August 1.	67.3	43.5	23.8	30.140	.2952		.2952	.3003	.2863
	5.	67.5	43	24.5	30.000	.2874		.2874	.2772	
	7.	66.2	42.4	23.8	30.218	.2774		.2774	.2825	
Hydrogen	June 21.	59	42.8	16.2	30.014	.4262	4	.4317	.3961	.4022
	27.	52.3	38.9	13.4	30.225	.4475	7	.4590	.4175	
	July 31.	65	46	19	30.330	.4000	7.5	.4099	.3946	
	August 4.	68	48	20	30.114	.4092	5	.4151	.4005	
Nitrous Oxide	August 4.	67.5	44.5	23	30.114	.3173	27.5	.3327	.3210	.3147
	7.	65	42.5	22.5	30.218	.3013	14	.3071	.3085	

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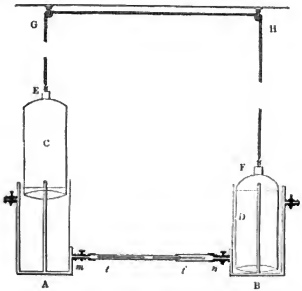
(3)

	Specific Heats of equal Volumes.	
Atmospheric Air	.2670	1.000
Azote.....	.2660	.996
Oxygen, (by calculation)	.2710	1.015
Hydrogen	.4022	1.506
Carbonic Acid	.2910	1.090
Carbonic Oxide.....	.2863	1.072
Nitrous Oxide	.3147	4.179

Upon these results I never placed much reliance. The apparatus employed was very imperfect, particularly in not permitting more than a single experiment on the same quantity of gas; and I also saw reason to doubt that I had in every instance by means of it accomplished perfect desiccation. Under these circumstances I always contemplated returning to the subject, and towards the latter end of last July, I did actually commence a fresh series of experiments, which were conducted on the following plan.



A pair of copper gasometers, A, B, with glass bells, C, D, such as are usually employed by chemical lecturers, were charged with a proper quantity of oil of

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vitriol, instead of water, and placed upon a table at the distance of three feet from each other, the brass caps, E, F, attached to the bells, being suspended to the extremities of a stout cord passing over a pair of runners, G, H, fixed in the ceiling of the laboratory, the length of the cord being such, that while one of the bells was almost entirely immersed in the oil of vitriol, the other dipped about an inch beneath its surface. Between the lower stop-cocks, *m*, *n*, attached to the gasometers, a couple of glass tubes were interposed, connected to the stop-cocks by caoutchouc collars, and fitting at their other extremities to each other by a tight ground joint. In the larger of these tubes the dry thermometer t was permanently placed, and into *it* also the wet one t' was introduced previous to the commencement of an experiment. Matters being, we shall suppose, thus prepared, and the unimmersed bell, *c*, occupied, *first* with atmospherical air, deprived by the oil of vitriol of its moisture, pressure was made upon it by an assistant, so as to force its contents in a rapid current into the second bell, D, through the tube containing the wet and dry thermometers. During this operation the observer kept his eye, armed with a lens, steadily fixed on the thermometers, and registered the indications of both as soon as the wet one became and continued stationary for a few seconds. The height of the barometer being now taken, the necessary *data* were obtained for calculating, from the formula

$$f'' = f' - \frac{48ad}{e} \times \frac{p}{30},$$

the elastic force of the vapour still existing in the air of the gasometer. The atmospheric air being now replaced by one of the gases which were to be the subject of experiment, and left sufficiently long in contact with the oil of vitriol, the very manipulations and observations just detailed were repeated. This same experiment, with sufficient intervals to allow in each instance of maximum desiccation, was again and again performed; and it having been ascertained, after a considerable number of repetitions, that the results were uniform and consistent, and that they might therefore be relied upon, the mean of all the observations was taken, and from this the specific heat of the gas deduced by means of the formula

$$a = (f' - f'') \times \frac{e}{48d} \times \frac{30}{p},$$

that value being assigned to f'' which resulted from the preliminary experiments

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on atmospherical air. The analysis of the gas was next very carefully performed, and it having been ascertained that n volumes *e. g.* of atmospheric air per cent. were present, the proper correction was applied by the formula

$$a' = a + \frac{(a-c)n}{100-n},$$

in which $c = .267$ is the specific heat of air, a' the true specific heat of the gas, and a the specific heat of mixture of gas and air as previously determined. Such was the course pursued in the case of each of the gases submitted to experiment.

The particulars of the entire series are comprehended in Tables (1) and (2), the first of which relates to air alone, the second to the different other gases. Table (3) contains the final results, alongside of which are placed the numbers of De la Roche and Berard, and those of Dulong, for the purpose of comparison.

(1)

1836.	t	t'	d	p	f''
August 8.....	63.5	40.3	23.2	30.226	
8.....	63.2	40.1	23.1	30.226	
8.....	63.2	40	23.2	30.226	
Mean	63.3	40.1	23.2	30.226	.0024
August 9.....	62.8	40.5	22.3	30.250	
9.....	63	40.8	22.2	30.250	
9.....	62.9	40.6	22.3	30.250	
9.....	63.5	41.1	22.4	30.250	
9.....	63.2	40.8	22.4	30.250	
Mean	63.1	40.7	22.4	30.250	.0134
Aug. 10.....	63	40.7	22.3	30.208	
10.....	64	41.5	22.5	30.208	
10.....	63.4	41.2	22.2	30.208	
10.....	63.6	10.9	22.7	30.208	
Mean	63.5	41.1	22.4	30.208	.0114
Aug. 11.....	62.2	40.9	21.3	30.310	
11.....	63	40.9	22.1	30.310	
11.....	63	41.5	21.5	30.310	
11.....	63.8	41.5	22.3	30.310	
11.....	63.2	41.7	21.5	30.310	
11.....	63.2	41.3	21.9	30.306	
11.....	64	41.4	22.6	30.306	
Mean	63.2	41.3	21.9	30.307	.0241
Aug. 12.....	66.5	41.8	24.7	30.270	.0063
15.....	65.8	41.9	23.9	30.070	——
15.....	66.5	41.4	25.1	30.070	
15.....	66.6	41.9	24.7	30.070	
Mean	66.3	41.7	24.6	30.070	.0027

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(2)

1836.		t	t'	d	p	a	Air per Cent.	a'
Carbonic Acid ..	August 8..	62.5	41.5	21	30.226		10.2	
	8..	62.6	41.5	21.1	30.226			
	8..	63	41.9	21.1	30.226			
	8..	63	42.3	20.7	30.226			
	8..	63.6	42.4	21.2	30.226			
	8..	63.7	42.4	21.3	30.226			
	8..	63.2	42.1	21.1	30.226		11.4	
	Mean.....	63.1	42	21.1	30.226	.3136	10.8	.3992
Hydrogen.....	August 8..	63.6	45.1	18.5	30.226	.3970	3.2	.4012
Hydrogen	August 9..	62.1	44.1	18	30.260		3.2	
	9..	62.6	44.1	18.5	30.260		3.6	
	9..	63	44.7	18.3	30.260		4	
	9..	62.8	44.7	18.1	30.260		4.4	
	9..	63	44.6	18.4	30.260		4.8	
	9..	63.8	45.1	18.7	30.250		5.2	
	9..	63	44.6	18.4	30.250		5.7	
	Mean.....	62.9	44.5	18.4	30.257	.3734	4.3	.3781
Nitrous Oxide ..	August 10..	62.1	42.1	20	30.200		14	
	10..	63	42.4	20.6	30.205			
	10..	63.6	42.6	21	30.210			
	10..	63	42	21	30.210			
	10..	63.5	42.5	21	30.210			
	10..	63.4	42.6	20.8	30.210		16	
	Mean.....	63.1	42.3	20.8	30.207	.3109	16	.3186
Equal volumes of Carbonic Acid and Carb. Oxide	August 11..	64.9	42.8	21.1	30.306			
	11..	65.4	43.3	22.1	30.306			
	11..	65.3	43.3	22	30.306			
	Mean.....	65.2	43.1	22.1	30.306	.2865		.2865
Equal volumes of Carbonic Acid and Carb. Oxide	August 12..	65.3	42.7	22.6	30.27			
	12..	65.8	43.4	22.4	30.27			
	12..	65.8	42.3	23.5	30.27			
	12..	65.3	42.6	22.7	30.27			
	Mean.....	65.5	42.7	22.8	30.27	.2988		.2988
Nitrogen.....	August 13..	64.8	41.9	22.9	30.07			
		66.8	42.3	24.5	30.07			
		66	42	24	30.07			
	Mean.....	65.9	42.1	23.8	30.07	.2799		.2799

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(3)

Specific Heats of equal Volumes.

	J. A.		De la Roche and Berard.	Dulong.
Atmospheric Air	.2670	1.000	1.000	1.000
Nitrogen	.2799	1.048	1.006	1.000
Oxygen*	.2154	.808	.976	1.000
Hydrogen	.3896	1.459	.900	1.300
Carbonic Acid	.3192	1.195	1.258	1.172
Carbonic Oxide†	.2660	.996	1.034	1.000
Nitrous Oxide	.3186	1.193	1.350	1.159

I shall conclude with the following propositions, which, if not established by, are, at least, in accordance with the results of my researches.

1st. The simple law so much insisted upon in modern times by Hayeraft, Marcet, and De la Rive, and others, that equal volumes of the different gases have the same specific heat, is not the law of nature.

2nd. The more limited proposition enunciated by Dulong, that the *simple* gases have under a given volume the same specific heat, is probably not true in a single instance,‡ and is altogether at variance with my result for hydrogen.

3rd. The numbers at which I have arrived correspond tolerably well with those of De la Roche and Berard, except in the case of hydrogen.

4th. There does not seem to be any simple relation between the specific heats of the gases, and their specific gravities or atomic weights; and philosophers, in searching for such, are probably pursuing a chimera.

* My number for this gas is deduced from that for nitrogen by the formula $x + 4 \times .2799 = 5$, in which x is the specific heat of oxygen, and .2799 that of nitrogen.

† My number for this gas is inferred by calculation from that given by experiment for the mixture of it with an equal volume of carbonic acid. The formula is $x = m + m - .3192$, x being the specific heat of carbonic oxide, .3192 of carbonic acid, and m of the mixture.

‡ I would not wish to be understood as speaking with much confidence of the numbers attached to nitrogen and oxygen. But three experiments were made, in consequence of one of the gasometers having begun to leak; and, moreover, as nitrogen was the gas operated with, in passing by calculation to the specific heat of oxygen, the errors of observation would be multiplied by four. Oxygen, in fact, not nitrogen, should have been the subject of experiment.

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II. *Analysis of a Meteoric Stone which fell near Adair, in the County of Limerick, on September* 10, 1813. *By* JAMES APJOHN, M.D., M.R.I.A., *Professor of Chemistry in the Royal College of Surgeons in Ireland.*

Read 23rd May, 1836.

THERE is no natural phenomenon more calculated to excite astonishment, or which has actually caused more surprise, than the fall of heavy bodies through the atmosphere. For a length of time the fact was altogether denied by the highest authorities in science, and the strongest evidence resisted, when adduced in support of an event which was conceived repugnant to the laws of nature. Philosophic incredulity, though generally useful, was, in this instance, carried too far, and proved injurious to the progress of science; for while doubts were entertained concerning the reality of stony showers, the sources of the aeroliths and their nature were not, of course, likely to be made objects of investigation. The occasional occurrence, however, of such a phenomenon having been at length established by incontrovertible testimony, the questions just alluded to were eagerly discussed, but by no means with the same degree of ardour or success. A multitude of hypotheses were almost immediately broached in reference to the origin of meteoric stones, but philosophers were more slow in applying themselves to the analysis of these singular bodies, though it might have been easily foreseen that a knowledge of their constitution and properties would, if not essential as a preliminary to the investigation, be at least very useful in all attempts to trace them to their origin. Mr. Howard, indeed, as is well known, was the first competent person who devoted himself to this latter research, and after an analysis of four distinct specimens of aeroliths, and as many of native iron, he was enabled to announce to chemists the following facts in reference to their composition:—

1st. That meteoric stones always contain an alloy of iron and nickel, the amount of which is subject to variation.

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2nd. That they contain a sulphuret of iron decomposable by muriatic acid.

3rd. That they contain an earthy matrix consisting of silex, magnesia, and oxide of iron.

4th. That the above-mentioned alloy of iron and nickel is identical with native iron.

5th. That the earthy matter sparingly attached to native iron is of the same nature with the matrix of meteoric stones.

To these results of Howard, Laugier made an important addition by the discovery of chrome as a component part of some aeroliths which he submitted to chemical examination.

From these sources alone, namely, the essay of Howard, and the paper just mentioned by Laugier, was any knowledge I possessed on the subject of the composition of aeroliths derived up to the time of my entering upon, and in a great measure completing the analysis of the specimen, to which I shall now proceed to draw the attention of the Academy.

The stone in question was given me by my friend, Daniel Reardon, Esq., of this city, and is one of a shower which fell near Adair, in the county of Limerick, in the year 1813. The shower is mentioned in Chladni's Catalogue, who states that one of the stones weighed eighteen pounds, and refers for further particulars to the Philosophical Magazine and Gentleman's Magazine of that period. I have looked carefully through the former journal for 1813, and the seven subsequent years, but have not been able to find the account referred to by Chladni. But in the Gentleman's Magazine for 1813, part 2, page 390, the following brief notice of the phenomenon occurs:—

"At Adair, county of Limerick, six o'clock in the morning, a shower of stones is stated to have fallen from a thunder cloud, extending about a mile and a half, with a sound like the discharge of artillery, followed by a noise resembling the rolling of drums. The air heavy and hot—several loud explosions—no lightning. Several of the stones weighed from one to four pounds. They are black outside, extremely heavy, much burned, and when broken of a dingy grey."

The mineralogical characters of the stone in my possession are so similar to those assigned by the Count De Bournon to the specimens examined by Howard, that a very cursory notice of them will be sufficient here. The weight is $1\frac{1}{2}$ lb.

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avoirdupois, its shape that of an irregular parallelepiped, and it is covered externally with a thin fused crust, of a dark colour, and sufficiently hard to strike fire with steel. When broken, the interior exhibits a pale yellow or greyish colour, and the surface of the fracture presents, particularly when examined with a lens, a number of metallic points, and two or three minute particles of what would appear to be iron pyrites. Its specific gravity is subject to variation, no doubt because of the metallic constituents being dispersed unequably throughout the mass. Thus, the portion first examined had a specific gravity of 4.230, while the density of another fragment of the stone reached but 3.621. When presented by any of its faces to a horizontal needle, attraction always took place, showing that it is susceptible of magnetism, but destitute of any permanent polarity.

By a number of preliminary experiments, the particulars of which it is not necessary to detail here, it was ascertained that the stone was composed of the following proximate constituents :—

1st. Native iron alloyed with nickel and cobalt.

2nd. Sulphuret of iron, soluble in muriatic acid.

3rd. Chrome iron ore.

4th. An earthy, or more probably two earthy minerals, composed of silex, magnesia, protoxide of iron, with traces of alumen, lime, and the oxide of manganese.

It was not examined for an alkali.

The quantative analysis was conducted as follows :—

Two hundred grains were reduced to a fine powder, and then treated with nitro-muriatic acid, which dissolved the iron with the copious evolution of nitric oxide, and at the same time developed sulphur and gelatinous silex; the former proceeding from pyrites, and the latter from the matrix of the stone. When, by the repeated additions of fresh portions of aqua regia, and a prolonged digestion, the sulphur was altogether acidified, the whole was evaporated to dryness, to render the silex insoluble, again acidulated with muriatic acid, and finally, distilled water being previously added, thrown upon a double filter. The matters detained by this were then repeatedly washed, by which the 200 grains of meteorite under experiment were resolved into a soluble portion (A), and an insoluble portion (B.) To the solution (A) chloride of barium was added, as long as there was any pre-

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cipitate; and the sulphate barytes collected on a double filter, well washed, and dried upon the edge of the sand bath, weighed 21.88 grains,* equivalent, as may be easily calculated, to three grains of sulphur, or 8.25 sulphuret of iron, provided the pyrites present be a binary compound.

To the washings of the sulphate of barytes, sulphuric acid was added, so as to throw down any excess of barytes used, and the whole having been passed through a single filter, a mixture of muriate of ammonia and water of ammonia was poured in until the latter became predominant in the fluid. The peroxide of iron thus precipitated, being collected on a double filter, washed, and dried on the edge of the sand bath, weighed 127.01 grains. Of this, 123.07 grains were solved in muriatic acid, and then boiled with a considerable excess of potash, which again threw down the iron; and the alkaline solution, upon examination in the usual manner, was found to contain a trace of alumen, which, however, was too insignificant to be weighed. The peroxide of iron collected on a double filter, washed and dried, was found to weigh 107.26 grains; and 106.16 of this, exposed to a red heat, were reduced to 78.73. Hence,

106.16 : 78.73 :: 107.26 : 79.54, and

123.07 : 79.54 :: 127.01 : 82.08 = peroxide of iron, in the solution (A), corresponding to 57.95 metallic iron.

To the solution deprived of the iron by ammonia, and which exhibited a greenish blue colour, hydro-sulphuret of ammonia was added, and the black precipitate formed (sulphuret of nickel) was washed upon a single filter. It was then transferred to a porcelain capsule, decomposed by nitro-muriatic acid, filtered, to separate the sulphur, and then precipitated by caustic potash. When washed upon a double filter and dried, the oxide of nickel weighed 4.39 grs. Of this 4.05 grains were exposed to a red heat, and thus reduced to 2.67. Hence,

4.05 : 2.67 :: 4.39 : 2.89 = the exact amount of the oxide of nickel, and which is equivalent to 2.28 metallic nickel.

The washings of the sulphuret of nickel were now treated with oxalate of ammonia, which threw down oxalate of lime amounting after desiccation at 212°

* The barytes was perfectly dry; for by exposure to heat it suffered no further loss.

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to 1.58 grs.; of this 1.07, heated to low redness, gave .63 of carbonate of lime. Hence,

1.07 : .63 :: 1.58 : .93 carbonate of lime, equivalent to .52 of lime.

The solution deprived of the lime was treated with carbonate of potash, added in considerable excess, and then evaporated to dryness. Water was now poured on, and the carbonate of magnesia which remained was collected, and well washed upon a double filter. When dried on the sand bath, it weighed 42.79 grs. 42.58 were exposed to a red heat, and reduced to 18.60. Hence,

42.58 : 18.60 :: 42.79 : 18.69 the magnesia.

The following therefore are the results of our analysis of solution (A.)

Sulphuret of Iron . . .	Sulphur . 3 Iron . . . 5.75	8.75
Iron = 57.95 − 5.75 =		52.20
Nickel		2.28
Magnesia		18.69
Lime		.52
		82.44

In this statement the whole of the iron is estimated in the metallic state. A part of it, however, is present as protoxide in the earthy matrix decomposed by the acids, and to determine the relative proportions of it in these two states, it is only necessary to know the total weight of the portion of the aerolith solved by the acids. Now this, as will presently appear, is 84.82 grs., hence, 84.82—82.44 =2.38 is the excess due to the oxidation of the iron. If then x=iron in the metallic state, $52.2-x$=that in the form of oxide, and $x+(52.2-x)\frac{36}{28}$ must be equal to $52.2+2.38=54.58$, an equation from which we obtain x the metallic iron=43.87; and $(52.2-x)\frac{36}{28}$, the protoxide,=10.71 grs. Substituting then these numbers for 52.2, we obtain, as follows, the true composition of the portion of the meteorite dissolved by the aqua regia.

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Sulphuret of iron	8.75
Iron	43.87
Nickel	2.28
Protoxide of iron	10.71
Magnesia	18.69
Lime	0.52
	84.82

This part of the analysis having been completed, it appeared to me that it would be interesting, before proceeding further, to examine the oxide of nickel above obtained, for the purpose of ascertaining whether it included any cobalt, these two metals being so frequently found associated in nature.

With this view 2.67 grs. of the oxide were dissolved in muriatic acid, and to the solution ammonia was added in excess, which threw down a very minute quantity of peroxide of iron. This latter being separated by filtration, caustic potash was added in considerable excess to the ammoniacal solution, and the oxide of nickel thus precipitated was separated by filtration. Through the filtered fluid sulphureted hydrogen was now passed. This, upon the application of heat, determined a small amount of dark precipitate, which, upon examination, proved to be sulphuret of cobalt. Thus it dissolved in nitric acid with the separation of sulphur; and the solution, when heated by the blowpipe with alumina, gave to this earth a beautiful blue colour. The quantity of the cobalt present was not determined, but its amount was undoubtedly extremely small.

We now return to the portion (B) of the aerolith, left unsolved by the nitro-muriatic acid. This portion of the stone, when dried upon the sand bath, was found to weigh 128.28 grs. Of this 114.12 were reduced by a red heat to 102.47. Hence, as 114.12 : 102.47 : : 128.28 : 115.18, the exact weight of the portion of the stone left undissolved by the acids.

The 102.47 grs. which had been exposed to heat were mixed in a platinum crucible with three times their weight of carbonate of potash, and fluxed at a strong red heat for twenty minutes. The fused mass was then transferred, by repeatedly boiling it with water, from the crucible to a porcelain capsule, dissolved in a dilute nitro-muriatic acid, and then cautiously evaporated to dryness. The dry

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residue having been now steeped for some hours with as much muriatic acid as was sufficient to moisten it, was then treated with distilled water, and collected on a double filter, on which the silex was washed, until the solution which passed through ceased to precipitate nitrate of silver. When dried upon the sand bath it weighed 94.71 grs.; 91.03 of this were reduced by a red heat to 66.87. Hence,

91.03 : 66.87 :: 94.71 : 69.57, the silex in the 102.47 of insoluble matter.

And, 102.47 : 69.57 :: 115.18 : 78.19, the total quantity of silex in (B).

To the washings of the silex, which were conceived to be sufficiently acid to admit of the omission of the sal-ammoniac without incurring the danger of precipitating any magnesia, caustic ammonia was added in excess, which threw down peroxide of iron, oxide of chrome, and with them what proved afterwards to be magnesia. These were collected as usual, and washed on a double filter, and when dried by a sand heat they weighed 31.37 grs.

The washings containing the magnesia with a trace of lime were boiled with carbonate of potash, and the whole being evaporated to dryness, and water again poured on, the precipitate was collected, and well washed on a pair of filters. When dried at 212° it weighed 38.17 grs. Of this 36.40 by a strong red heat were reduced to 17.40. Hence,

36.4 : 17.4 :: 38.17 : 18.24.

And 102.47 : 18.24 :: 115.18 : 20.50, the mixed magnesia and lime in (B).

Of the mixture of peroxide of iron and oxide of chrome with trace of magnesia, amounting to 31.37 grs., 31.07 were dissolved in muriatic acid, and muriate of ammonia being first added, the peroxide of iron and oxide of chrome were again thrown down by ammonia, which left the magnesia in solution. The oxides were collected, and washed on a single filter, and the washings, when boiled with carbonate of potash, gave a deposit of carbonate of magnesia, which, when washed, and dried at a sand heat, weighed 4.11 grs. 3.45 grs. of this were reduced by a red heat to 1.99. Hence,

3.45 : 1.99 :: 4.11 : 2.30, magnesia in the 31.07 grs.

And 31.07 : 2.30 :: 31.37 : 2.32, magnesia precipitated with the oxides.

And 114.12 : 2.32 :: 115.18 : 2.34, magnesia to be in this step obtained from B, the unsolved portion of meteorite.

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The peroxide of iron and oxide of chrome were next washed off the single filter, and dissolved in muriatic acid. To the solution tartaric acid was then added in such quantity that upon subsequently adding ammonia in excess there was no precipitate. The iron was now thrown down as sesquisulphuret by the hydrosulphate of ammonia, and the precipitate, when collected on a single filter, was well washed with distilled water. It was then transferred to a porcelain capsule, in it decomposed by nitro-muriatic acid, and after filtering to separate sulphur, the solution was precipitated by the addition of ammonia in excess. The peroxide of iron, when dried on a sand bath, weighed 14.42 grs.; 13.23 grs. of this exposed to a red heat were reduced to 6.29. Hence,

13.23 : 6.29 :: 14.42 : 6.85, true weight of peroxide of iron.

31.07 : 6.85 :: 31.37 : 6.91

102.47 : 6.91 :: 115.18 : 7.76, the peroxide of iron in the entire of the fluxed portion of the meteorite. And

41 : 36 :: 7.69 : 6.98, the corresponding weight of protoxide, which is the form in which it exists in the stone.

The solution from which the iron was thrown down by the hydro-sulphate of ammonia, and which had a deep green colour, was concentrated on the sand bath, then filtered to separate sulphur, and finally evaporated to dryness, and ignited in a platinum crucible to destroy the tartaric acid. To the residue, which had a carbonaceous appearance, nitre was added, and heat being applied, the charcoal was burned off, and the oxide of chrome, at the same time, converted into chromate of potash, the whole was then acted upon by distilled water, and thrown upon a filter, which allowed the chromate of potash to pass through with carbonate of potash and excess of nitre, and detained a small quantity of insoluble matter, of a rusty colour, (magnesia, with deutoxide of manganese,) which was estimated, though in consequence of an accident not with any great precision, to amount to 1.08 grs.

The solution containing the chromate of potash was acidulated with muriatic acid, boiled, and treated first with alcohol, and next with an excess of ammonia, the former of which reduced the chromic acid to the state of chromic oxide; while the latter threw down the oxide from its combination with the muriatic acid. After desiccation on the sand bath it weighed 9.87 grs. Of these 8.97 were reduced by a red heat to 3.70. Hence,

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$$8.97 : 3.70 : 9.87 : 4.07$$

the true weight of oxide of chrome in 31.07 out of 31.37 grains of the mixture chrome iron and magnesia; and therefore

$$31.07 : 4.07 :: 31.37 : 4.11$$
$$\text{And } 102.47 : 4.11 :: 115.18 : 4.61,$$

the oxide of chrome in 200 grains of the meteorite.

The results of the analysis of (B) are, therefore, as follows:—

Silex	78.19
Magnesia, a little lime, and a trace of oxide of manganese	23.92
Protoxide of iron	6.98
Oxide of chrome	4.61
Alkalies and loss	1.48
	115.18

If we collect from (A) and (B) the silex, the magnesia, the lime, the manganese, and the protoxide of iron, deducting from this latter 2.07 grains, the quantity associated in the stone with the 4.11 grains of oxide of chrome, we will have for the matrix the following constituents:—

Silex	78.19
Magnesia, &c.*	43.13
Oxide of iron	15.62
	136.94

Now if these numbers be divided by the respective atomic weights, we obtain the following results:—

$$\frac{78.19}{15.5} = 5.04$$

$$\frac{43.13}{20.7} = 2.08$$

$$\frac{15.62}{36} = 0.43$$

* The lime and manganese being inconsiderable in amount, are incorporated with the magnesia.

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But 5.04 is to 2.08 + .43 almost exactly as 2 : 1. So that we thus arrive at the very interesting conclusion that the matrix of the stone is a bisilicate of magnesia and oxide of iron; that is, a true augite, or pyroxene.

This latter result, namely, the identification of the earthy base of the aerolith with a well known volcanic mineral, and the detection, for the first time, as far as I was aware, of cobalt, in association with the iron and nickel, appeared to me to be, *per se*, points of sufficient importance to justify me in laying them before the Academy. But even though nothing new had been disclosed by the chemical examination, I could not doubt but that an interest would be felt in the results of a carefully-made analysis of one of those mysterious bodies (one, too, which has fallen in our own country) whose existence was once denied, and in relation to whose source we have as yet little better than vague conjecture.

The analysis just detailed was completed early in March, and would have been communicated to the Academy at its general meeting of that month, but for the following circumstance.

Mr. Nathaniel Hone, of this city—a gentleman who has devoted himself, in my laboratory, with great zeal and considerable success, to the cultivation of analytical chemistry—while repeating, at my request, the chemical examination of this stone, drew my attention to the unusually light colour of the peroxide of iron which he had extracted, in the usual way, from the portion insoluble in acids, and which we have already designated by the letter (B). This, we found, was not due to alumine, for none of this earth could be extracted by potash, nor was the colour of the precipitate altered by digestion with the alkali. Neither did I suspect it, at the time, to be owing to magnesia, having been assured that the usual precautions were taken to prevent the precipitation of any of this earth upon the addition of the volatile alkali. With a view, therefore, to a further investigation of the matter, the peroxide of iron was well washed with distilled water, to remove all trace of potash; and, being then transferred to a porcelain capsule, it was heated, with a solution of oxalic acid gradually added, which dissolved the iron, and left a small quantity of a white precipitate. This latter, being well washed, dried, and ignited in a platinum crucible, gave a brownish residue, which was easily shown to be magnesia, coloured by deutoxide of manganese. Such was the pursuit that prevented me from sooner submitting the results of my analysis to the judgment of the Academy.

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While engaged in this latter investigation, which I, at one time, supposed likely to eventuate in something more important, I had a visit from my friend Doctor Smith, one of our members, who informed me that he was just after reading, in the number of the Journal De Pharmacie for February, an extract from a paper by Berzelius, on the subject of meteoric stones. This information could not fail to interest me much, and having received from him, on the evening of the same day, the number of the journal in question, I opened it with the apprehension that I should find myself, as far as respected any novelty in the results of my analysis, anticipated by the great Scandinavian chemist. My suspicions proved to be well founded. Berzelius finds, in four distinct meteoric stones, the first of which fell at Blansko in Moravia, the second at Chantonnay in La Vendée, the third at Lontalax in Finland, and the fourth at Alais in France, as also in the meteoric iron of Elbogen, preserved in the museum at Vienna, and in the celebrated mass discovered by Pallas in Siberia, the following substances :—

1st. Cobalt, which I conceived I had been the first to notice. 2d. Tin. 3rd. Copper. 4th. Phosphorus, all in very small quantity, and in association with the alloy of iron and nickel. 5th. Potash and soda, also in very minute proportion.

Thus far it will be seen there is no contradiction between my results and those of Berzelius. The former, in fact, are, as far as they go, in complete accordance with the latter. There are, however, two important points, in reference to which we are at variance. In the first place, he assumes the chrome to be present in the form of an alloy with iron ; whereas I consider it as existing in its usual state, or in the form of oxide of chrome combined with protoxide of iron. As the article in the Journal De Pharmacie is but an extract from a German periodical, (Annalen der Physik und Chemie,) and merely gives results, but none of the details of the analytic processes, I am quite ignorant of the grounds of this opinion. The reasons that have suggested the view which I have myself adopted are—1st. That chrome often occurs in the form I have supposed. 2nd. That I am not aware of any such native alloy as that of chrome and iron. I have never seen it, and it is not described in books. 3rd. If such existed, the portion of the stone insoluble in acids would, while fluxing, in all probability injure or destroy the platinum crucible, an effect which I have never witnessed.

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The other point of discrepancy between us, is one, at least in a theoretical point of view, of greater consequence. I have already stated, that according to my experiments, the matrix of the Limerick stone is augite, or a mixed bisilicate of magnesia and protoxide of iron. Berzelius finds the earthy base of the aeroliths he has analysed to be composed of bisilicates and silicates of the same bases, or, in fact, to be a mixture of augite and olivine, the former of which is insoluble, and the latter soluble in the diluted mineral acids. On this head it might be considered sufficient for me to observe, that the hypothesis I have made will alone represent my own results, and that as olivine alone occurs in some aeroliths, *e. g.* the meteoric mass of Pallas, so pyroxene, unmixed with olivine, may exist as the base of others. It would, however, be uncandid in me not to state my suspicion that the matrix of the stone I have examined, is in reality composed of two earthy minerals, differing, if not in composition, at all events in the circumstance of the one being soluble, and the other insoluble in acids. This circumstance I observed in my preliminary experiments upon the stone, and I have in more than one place alluded to it in the course of my analysis. Notwithstanding, therefore, the perfect correspondence of my theory with my quantitative results, I would wish, finding myself in opposition to such high authority, to be understood as propounding the theory with some degree of diffidence. I am indeed at present engaged in further researches, which will, I trust, shortly enable me to speak with more confidence on the subject.

The following analysis has since been made, and the results, it will be seen, are in accordance with the views of Berzelius.

72.76 grains of the meteorite, carefully deprived of all magnetic parts, were resolved, by a prolonged digestion with nitro-muriatic acid, evaporation to dryness, solution in acidulous water, and filtration, into two portions, A and B, the former being dissolved by the acid, and the latter left behind. The soluble portion A, analysed in the ordinary way, gave

Sulphuret of iron	4.34
Protoxide of iron	7.38
Oxides of nickel and cobalt . . .	0.24
Magnesia	13.38
	25.34

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And the insoluble portion, B, yielded,

Silex	32.11
Protoxide of iron and oxide of chrome	5.91
Magnesia and a little lime . . .	9.43
	47.45

If then we exclude the pyrites, the following will be the component parts of matrix of meteorite :—

Silex	32.11
Oxides of iron, nickel, cobalt, and chrome	13.53
Magnesia, with a little lime . . .	22.81
	68.45

But

$$\frac{32.11}{15.5} = 2.07$$

$$\frac{13.53}{36} = 0.37$$

$$\frac{22.81}{20.7} = 1.10$$

Hence, the number of atoms of silex in the matrix of the stone is to the sum of the numbers of atoms of protoxide of iron and of magnesia, as 2.07 to 0.37+1.10, or as 3 to 2.13. Now, as the atom of lime is greater than that of magnesia, and as the oxide of chrome and its associated iron do not exist in combination with silex, the latter number, 2.13, must be a little too high, so that the decimal part, at least, may be safely omitted. The number of atoms of silex will thus come out to be to the sum of the numbers of atoms of the bases with which it is combined, as 3 to 2; so that the stone is composed of an atom of a silicate, associated with an atom of a bisilicate, or, in other words, of an atom of olivine united to an atom of pyroxene. That such is the true composition of the portion of the meteorite under consideration, there can, I conceive, be no question, for the matrix is obviously composed of two distinct minerals, one of which, like olivine, is soluble, and the other, like augite, insoluble in the acids.

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Some other rough experiments have shown that the relative quantities of the two minerals is different in different parts of the stone, and that the proportion of the olivine is in particular sometimes very small. In this way alone can I account for the results of my first analysis, which make the earthy basis of the meteorite an amorphous pyroxene.

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III. *On the Laws of Crystalline Reflexion and Refraction.* By James Mac Cullagh, *Fellow of Trinity College, Dublin.*

Read 9th January, 1837.

When a ray of light, which has been polarised in a given plane, suffers reflexion and refraction at the surface of a transparent medium, the rays into which it is divided are found to be polarised in certain other planes; and it becomes a question to determine the positions of these planes, as well as the relative intensities of the different rays; or, in theoretical language, to find the direction and magnitude of the reflected and refracted vibrations, supposing those of the incident vibration to be given. The transparent medium may be either a singly refracting substance, such as glass, or a doubly refracting crystal like Iceland spar. When the medium is of the first kind, the problem is comparatively simple, being, in fact, nothing more than a particular case of the problem which we have to consider when the medium is supposed to be of the second kind. In the progress of knowledge it was natural that the simpler question should be first attended to; and accordingly Fresnel, during his brief and brilliant career, found time to solve it. But the general problem, relative to doubly refracting media, had not been attempted by any one, when, in the year 1834, my thoughts were turned to the subject. I then recollected a conclusion to which I had been led some years before, and which, on this occasion, proved of essential service to me. Being fond of geometrical constructions, I amused myself, when I first became acquainted with Fresnel's theories, by throwing his algebraical expressions, whenever I could, into a geometrical form; and treating in this way the well-known formulæ in which he has embodied his solution of the problem just alluded to, I obtained a remarkable result, which gave me the first view of the principle that I have since employed under the name of the *principle of the equivalence of vibrations*. In order to state this result

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briefly, I will take leave to introduce a new term for expressing a right line drawn parallel to the plane of polarisation of a ray, and perpendicular to the direction of the ray itself. Calling such a right line the *transversal* of the polarised ray, I found, from the formulæ of Fresnel, that when polarised light falls upon a singly refracting medium, the transversals of the incident, of the reflected, and of the refracted rays are all parallel to the same plane, which is the plane of polarisation of the refracted ray; and that the magnitudes of the vibrations, or the greatest excursions of the ethereal molecules, in the incident and the reflected rays, are to each other inversely as the sines of the angles which the respective transversals of those rays make with the transversal of the refracted ray. I was struck by the strong analogy which these relations among the transversals bore to the composition of forces or of small vibrations in mechanics; but it happened unfortunately, that, in the theory of Fresnel, the vibrations of light were supposed to take place, not in the direction of the transversals, but perpendicular to them, so that there was no physical circumstance to support the analogy, there being no motion in the direction of the transversals; while, on the other hand, no such analogy existed among the vibrations themselves in the directions which Fresnel had assigned to them. It was therefore with some interest that I afterwards learned, upon the publication of the tenth volume of the Memoirs of the Institute, that M. Cauchy* had actually inferred, from mechanical principles, that the vibrations of polarised light are in the direction of the transversals; but this inference was to be received with caution, as being contrary to the hypothesis of Fresnel; and besides, I had in the mean time contrived a way of adapting my analogy, in some degree, to that hypothesis, by supposing *areas* to be compounded instead of vibrations; so that I hesitated which of the two opinions to prefer. Taking, however, the opinion of M. Cauchy as that which fell in more naturally with the aforesaid analogy, I was led to the conclusion, that the vibration in the refracted ray is probably the resultant of the incident and reflected vibrations; and I saw that if this principle were true for singly refracting media, it should also, from its very nature, be true, when properly generalised, for doubly refracting crystals; so that in such crystals the resultant of the two refracted vibrations would be the same, both in length and direction, as the resultant of the incident and reflected vibrations.

* Mémoires de l'Institut, tome x. p. 304.

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This was the principle of *equivalent vibrations*. But I had no sooner begun to regard it as probable, than an objection started up against it. In the case of a ray ordinarily refracted out of a rarer into a denser medium, the magnitude of the refracted vibration, as deduced from this principle, was greater than that which came out from the theory of Fresnel, in the proportion of the sine of the angle of incidence to the sine of the angle of refraction. Consequently, assuming with Fresnel, that the ether is more dense in the denser medium, the law of the preservation of *vis viva* was violated.

There was another embarrassment which I felt in my early efforts to find out the laws of crystalline reflexion. Taking for granted the hypothesis of Fresnel, that the density of the ether in an ordinary medium is inversely as the square of its refractive index, I was at a loss what hypothesis to make, in this respect, for doubly refracting crystals, wherein the refractive index changes with the direction of the ray. For the density, being independent of direction, could not be conceived to vary with the refractive index. About two years ago, I got over this difficulty by supposing the density of the ether to be the same in all media.* At the same time I was compelled to employ the principle of equivalent vibrations, in order to have a sufficient number of conditions, though for a while I overlooked the perfect agreement which now subsisted between this principle and the law of *vis viva*; it happened, in fact, that the new hypothesis of a constant density made the *vis viva* of the refracted ray exactly the same as in the theory of Fresnel.†

But to see why it was necessary to assume the principle of equivalent vibrations, we must observe, that when a polarised ray is incident on a crystal, there are four things to be determined, namely, the direction and magnitude of the reflected vibration, and the magnitudes of the two refracted vibrations. Hence we must have four conditions, or we must have relations affording so many equations. But the hypotheses of Fresnel, by which he solved the problem of

* This hypothesis is maintained by Mr. Challis; and certainly it falls in extremely well with the astronomical phenomenon of the aberration of light.—See, on this subject, Professor Lloyd's Report on Physical Optics, Fourth Report of the British Association for the Advancement of Science, pp. 311, 313.

† See hereafter, p. 42, *note*.

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reflexion for ordinary media, afford only three conditions. We will state his hypotheses at length :—

1st. The vibrations of polarised light are in the plane of the wave, and *perpendicular* to the plane of polarisation.

2nd. The density of the ether is inversely as the square of the refractive index of the medium.

3rd. The *vis viva* is preserved.

4th. The vibrations parallel to the separating surface of two media are equivalent; that is, the refracted vibration parallel to the surface is the resultant of the incident and reflected vibrations parallel to the same.

We see that the fourth hypothesis gives two conditions, and the law of *vis viva* gives a third.

Let us now take the more general principle of equivalent vibrations, in place of the fourth hypothesis of Fresnel, altering the first hypothesis in the way that we have shown to be necessary in order to suit that principle, and making the ethereal density constant. Then, if we retain the law of *vis viva*, our new hypotheses will be these :—

1st. The vibrations of polarised light are in the plane of the wave, and *parallel* to the plane of polarisation; which may be expressed in a word, by saying that the vibrations are *transversal*, according to the peculiar sense in which I use the term.

2nd. The density of the ether is the same in all bodies as in *vacuo*.

3rd. The *vis viva* is preserved.

4th. The vibrations in two contiguous media are equivalent; that is, the resultant of the incident and reflected vibrations is the same, both in length and direction, as the resultant of the refracted vibrations.

It is evident that the last hypothesis affords three equations, by resolving the vibrations parallel to three axes of coordinates; and the law of *vis viva* supplies a fourth equation. Thus we have the requisite number of conditions.

The hypotheses that we have last enumerated are those which will be employed in the present paper. They have been made to include the law of *vis viva*, because I lately found that this law must necessarily accompany the rest; but at first I neglected it, and even made considerable progress without it; for, by the help of another hypothesis, I obtained formulæ which represented such expe-

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riments as I was aware of at the time. This other hypothesis I took up from reading an article by M. Cauchy in the Bulletin des Sciences Mathématiques,* in which he arrives, by a peculiar process, at the formulæ of Fresnel for the case of ordinary reflexion. The hypotheses which he chiefly employs are relations among certain quantities called pressures; and it was such a relation that I adopted instead of the law of *vis viva*. I supposed that, at the confines of two media, the pressure on the separating surface, in a direction perpendicular to the plane of incidence, ought to be the same, whether it be considered as resulting from the vibrations in the first medium or in the second. This hypothesis I conceived to be true in general, because I found it to be true for ordinary media; but I could never assign any better reason for it. Combining it, however, with the principle of equivalent vibrations, I deduced several expressions for uniaxal crystals, and among others a formula for the polarising angles in different azimuths of the plane of reflexion. When this

* Sur la Réfraction et la Réflexion de la Lumière, Bulletin des Sci. Math. Juillet, 1830. In this paper the vibrations of polarised light must be supposed perpendicular to the plane of polarisation, though the paper was published immediately after the author had promulged the contrary opinion. The latter opinion, which I adopted from him because it harmonized with my analogy before mentioned, he has formally renounced of late, and has returned to the hypothesis of Fresnel. M. Cauchy supposed too, in the above paper, that the ethereal density is the same in different media; but he has found cause to abandon this hypothesis also. See his notes addressed to M. Libri, in the Comptes rendus des Séances de l'Académie des Sciences, Séance du 4 Avril, 1836, where he gives the reasons for his present opinions. He says, "Ainsi Fresnel a eu raison de dire, non-seulement que les vibrations des molécules éthérées sont généralement comprises dans les plans des ondes, mais encore que les plans de polarisation sont perpendiculaires aux directions des vitesses ou des déplacements moléculaires. J'arrive au reste à cette dernière conclusion d'une autre manière, en établissant les lois de la réflexion et de la réfraction à l'aide d'une nouvelle méthode qui sera développée dans mon mémoire.....[cette méthode] ne m'oblige plus à supposer, comme je l'avais fait dans un article du *Bulletin des Sciences*, que la densité de l'éther est la même dans tous les milieux. Mes nouvelles recherches donnent lieu de croire que cette densité varie en général, quand on passe d'un milieu à un autre." More lately, in his Nouveaux Exercices de Mathématiques, 7e Livraison, M. Cauchy states positively that his principles do not permit him to adopt the hypothesis that the density of the ether is the same in all media. He also gives the differential equations which, as he has found by his new method, ought to subsist at the separating surface of two media, and from which he has obtained the formulæ of Fresnel for ordinary reflexion. But these equations do not include the laws of crystalline reflexion.

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formula was compared with the experiments of Sir David Brewster* on the polarising angles of Iceland spar, the accordance was so satisfactory, as to leave no doubt upon my mind that I had arrived at the true formula for these angles; and though the truth of the conclusion did not allow me to argue that the premises were true, yet the presumption in their favour was very strong, insomuch that, upon remarking, as I did soon after, that the law of *vis viva* harmonized with my other hypotheses, I did not think it worth while† to try what would be the consequence of using this law, instead of the relation which I had put in its place. In this state of my theory, I gave an account of it at the meeting of the British Association‡ in Dublin, in August, 1835; and the leading steps and results were afterwards published in a letter to Sir David Brewster.§

Now we are to observe, that when common light is polarised by reflexion at the surface of a doubly refracting crystal, the plane of polarisation does not, in general, coincide with the plane of reflexion, as in the case of ordinary media, but is inclined to it at a certain angle, which may be called the *deviation*; and it was by equating two values of the deviation that I obtained the formula above mentioned for the polarising angle. This formula, as we have seen, was correct; but it happened, singularly enough, that the expressions for the deviation, which

* Phil. Trans. 1819, p. 150.

† I had, besides, an objection to the law of *vis viva*, on the ground that it would give an equation of the second degree; and I wished to have all my equations linear, lest, in the seemingly complicated question of crystalline reflexion, they should give two answers when the nature of the question required but one. This has actually happened, since the present paper was read, in applying my hypotheses to the case of *internal* reflexion at the second surface of a uniaxal crystal. Supposing an ordinary ray to emerge after double reflexion, and putting ϕ for the angle which the emergent transversal makes with the plane of incidence, I found, for determining θ, an equation of the form

$$A + B\tan\theta + C\tan^2\theta = 0,$$

wherein A is very small, but does not vanish; so that the equation gives two roots, one very small, the other about the proper value. It is clear, therefore, that there is a want of adjustment somewhere; but I am now inclined to think that the fault is not in the principle of *vis viva*. Possibly our laws of the propagation of light in doubly refracting media are not quite accurate. Whatever supplementary law shall be found to remedy this untoward result, will probably, at the same time, account for the extraordinary phenomena observed by Brewster, in reflexion at the *first* surface, when the crystal is in contact with a medium of nearly equal refractive power.

‡ London and Edinburgh Philosophical Magazine, vol. vii. p. 295.

§ Ibid. vol. viii. p. 103; February, 1836.

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were used in obtaining the formula, were erroneous. It is to M. Seebeck that I am obliged for pointing out this curious circumstance. In Poggendorff's Annals,* he gave an abstract of my letter to Sir David Brewster, and compared my results with his own numerous and accurate experiments, both on the polarising angles of Iceland spar and on the angles of deviation. He found that my formula represented the former class of experiments as well as could be wished; but the theoretical values of the deviations did not at all agree with his experimental measures. These measures of the deviation he published on this occasion; and, with their assistance, I traced the error to its source, which was the relation among the pressures. The principle of *vis viva* was therefore introduced, instead of that relation, and the theory became much simpler by the change. I now obtained, for the deviation, a new expression, which agreed with the experiments of M. Seebeck; but the formula for the polarising angle came out the very same as before. This correction was made on the 6th of December, and was published in the Philosophical Magazine† on the first of the present month.

In the interval I have arrived at very elegant geometrical laws, which can be easily remembered, and which embrace the whole theory of crystalline reflexion. In enunciating these, it will be convenient to draw our transversals always through the same origin O, which we shall suppose to be the point of incidence, as this point is common to all the rays, whether incident, reflected, or refracted; and we may imagine wave planes to be drawn through the origin, parallel to the plane of each wave, so that every transversal will lie in its own wave plane. The incident and reflected wave planes will be perpendicular to the incident and reflected rays, but the two refracted wave planes will in general be oblique to their respective rays. In the latter case, a right line drawn through the origin perpendicular to the wave plane, is called the wave normal. It is scarcely necessary to remark, that all the four wave planes intersect the surface of the crystal in the same right line which is perpendicular to the plane of incidence; and that the angles of refraction are the angles which the refracted wave normals make with a perpendicular to that surface. The index of refraction is the ratio of the sine of the angle of incidence to the sine of the angle of refraction, just as

* Annalen der Physik und Chemie, vol. xxxviii. p. 276.

† London and Edinburgh Philosophical Magazine, vol. x. p. 43.

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in ordinary media; but here it is a variable ratio, and has different values for the same angle of incidence. I have elsewhere* shown how to find the refracted rays and waves when the incident ray is given.

As we suppose the ethereal molecules to vibrate parallel to the transversals, we may take the lengths of the transversals proportional to the magnitudes or amplitudes of the vibrations; these lengths being always measured from the common origin O. Then, in virtue of our fourth hypothesis, the transversals will be compounded and resolved exactly by the same rules as if they were forces acting at the point O.

We must now conceive a wave surface of the crystal, with its centre at O, the point of incidence. As the velocities of rays which traverse the crystal in directions parallel to the radii of its wave surface are represented by those radii, so let a concentric sphere be described with a radius OS, which shall represent, on the same scale, the constant velocity of light in the medium external to the crystal. At any point T on the wave surface apply a tangent plane, on which let fall, from O, a perpendicular OG, meeting the plane in G. On this perpendicular take the length OP from O towards G, so that OP shall be a third proportional to OG and the constant line OS. Then while the point T describes the wave surface, the point P will describe another surface reciprocal† to the wave surface. This other surface may very properly be called the *index surface*,‡ because its radius OP is the refractive index of the ray whose velocity is OT, or rather of the wave TG, which belongs to that ray; for, if we conceive an incident wave, touching the sphere, to be refracted into the wave TG, touching the wave surface in T, the sine of the angle of incidence will be to the sine of the angle of refraction as OS to OG, or as OP to OS; so that, taking the constant OS for unity, the index of refraction will be represented by OP. The wave surface and the index surface will thus be reciprocal to each other,

* Irish Acad. Trans. vol. xvii. p. 252.

† For the general theory of reciprocal surfaces, see Irish Acad. Trans. vol. xvii. p. 241.

‡ This is the surface which I formerly called (ibid. p. 252) the *surface of refraction*; a name not sufficiently descriptive. Sir W. Hamilton has called it the *surface of wave slowness*, and sometimes the *surface of components*. But the name *index surface* seems to recommend itself, as both short and expressive.

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every point T on the one having a point P reciprocally corresponding to it on the other.

It is remarkable that the transversal of the ray OT is perpendicular to the plane OPT; for in the theory of Fresnel, as I formerly proved,* the direction of the vibrations is the right line TG; and as I suppose the transversal to be perpendicular to the vibrations of that theory, and to be, at the same time, in the wave plane, which is perpendicular to OP, it follows that the transversal must be perpendicular to both the right lines TG and OP, and therefore perpendicular to their plane OPT. Therefore conceiving the transversal to be drawn through O at right angles to the plane OPT, the plane of polarisation of the ray OT must needs pass through it. But there is nothing else to fix the position of this last plane. We may make it pass through the ray itself OT, as in ordinary media, or we may draw it through the wave normal OP with Fresnel. Or, instead of drawing it through either of these two sides of the triangle OPT, we may make it parallel to the third side PT. The last is what I should prefer, because the plane so determined possesses important properties. I shall call it, however, the *polar plane*, because the name, plane of polarisation, is a long one; and the signification of the latter may, if any one chooses, be kept distinct, though in an ordinary medium both terms must mean the same thing. The polar plane then of the ray OT is a plane passing through its transversal and parallel to the right line PT; so that if OK be drawn parallel to PT, the polar plane will pass through OK. In general, to find the transversal and the polar plane of any ray, we take the point where the ray meets *its own* nappe of the wave surface, and join it with the corresponding point on the index surface, drawing a plane through the origin and the joining line. Then a right line perpendicular to this plane at the origin will be the transversal, and a plane drawn through the transversal parallel to the joining line will be the polar plane.

Now let a polarised ray be incident at O upon the crystal. It will in general be divided into two rays. But each of these rays in turn may be made to disappear by polarising the incident ray in a certain plane. Let us suppose then that there is only one refracted ray OT. In what direction must the incident ray be polarised, or, in other words, what must be the position of its transversal, in order that this may be the case? and what will be the correspond-

* Ibid. vol. xvi. p. 76.

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ing transversal of the reflected ray? The answer is simple—*both transversals will lie in the polar plane of the refracted ray*. Let us pursue this remark a little.

The refracted ray OT being given, we can find its polar plane, and thence the intersections of this plane with the incident and reflected wave planes. These intersections will be the positions of the incident and reflected transversals when OT is the sole refracted ray. The refracted transversal lies also in the polar plane; and this transversal is, by our fourth hypothesis, the diagonal of a parallelogram, whose sides are the other two transversals; which determines the relative lengths of the three transversals, or the relative amplitudes of the vibrations. The intensities of the reflected and incident rays are, of course, proportional to the squares of their transversals. When the ray OT disappears, we must take the polar plane of the other ray, and proceed as before.

Thus there are, in the incident wave plane, two transversal directions which give only a single refracted ray. These, as well as the corresponding ones in the reflected wave plane, may be called *uniradial* transversals. They are the intersections of the two refracted polar planes with the incident and reflected wave planes.

When the incident transversal does not coincide with either of the uniradial directions, it is to be resolved parallel to them, and then each component transversal will supply a refracted ray, according to the foregoing rules. The reflected transversals, arising from the component incident ones, are to be found separately by the same rules, and then to be compounded.

In ordinary reflexion, if the incident transversal be in the plane of incidence, or perpendicular to it, the reflected transversal will be so likewise. But this does not hold in crystalline reflexion. The general method just given will, however, enable us to determine the positions and magnitudes of the reflected transversals in these two remarkable cases; and then, if we choose, we can reduce any other case to these two, by resolving the incident transversal in directions parallel and perpendicular to the plane of incidence.

If we conceive a pair of incident transversals, at right angles to each other, to revolve about the origin, it is evident that there will be a position in which the reflected transversals corresponding to them will also be at right angles to each other. There is no difficulty in finding this position, and there will be an

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advantage in using it when common unpolarised light is incident on the crystal. For, the incident transversals being rectangular, we may suppose the light to be equally divided between them, and then the intensities of the corresponding reflected portions can be found by the preceding rules. As the reflected transversals are also rectangular, the sum of these intensities will be the whole intensity of the reflected light, and their difference will be the intensity of the polarised part of it. This part will be polarised in a plane passing through the greater of the two reflected transversals.

Common light will be completely polarised by reflexion when the two uniradial directions in the reflected wave plane coincide with each other; that is, when this plane and the two refracted polar planes have a common intersection. For then, if the incident light be polarised, it is manifest that the reflected transversal will lie in that intersection, whatever be the position of the incident transversal; and therefore if common light be incident, with its transversals in every possible direction, the reflected transversals will have but one direction. Thus the reflected light will be completely polarised in a plane passing through the above intersection.

Hence, as the reflected ray is perpendicular to its wave plane, it follows that, *at the polarising angle of a crystal, the reflected ray is perpendicular to the intersection of the polar planes of the two refracted rays.* The reflected transversal, as we have seen, is this very intersection. This transversal is inclined, in general, to the plane of incidence, and we have had occasion to speak of its inclination under the name of the *deviation*. If we now suppose the double refraction to diminish until it disappears, the intersection of the polar planes will at last coincide* with the refracted ray. There will then be no deviation, and the reflected and refracted rays will be at right angles to each other, agreeably to the law of Brewster, which prevails at the polarising angle of an ordinary medium.

There is a case in which the construction that we have given for determining the polar plane of a ray becomes useless. It is when the ray OT is a normal to the wave surface; for then OP coincides with OT, and we cannot fix the transversal by our construction. But it is precisely in such a case that the polar

* For the polar planes will become two planes of polarisation at right angles to each other.

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plane is most easily ascertained, for it is then nothing more than the plane of polarisation of the common theory. For example, if we take the ordinary ray of a uniaxal crystal, its polar plane will pass through the ray itself and the axis of the crystal. Of course in an ordinary medium the polar plane and the plane of polarisation are synonymous.

It may not be amiss to apply our general rules to the case of ordinary reflexion and refraction. Suppose then a polarised ray to fall on the surface of an ordinary medium. Draw a plane through the incident transversal and the refracted ray; this will be the plane of polarisation of the refracted ray, and it will intersect the reflected wave plane in the reflected transversal. The refracted transversal will be the diagonal of a parallelogram, whose sides are the other two transversals; hence we have the relative lengths of the transversals, and thus every thing is determined.*

* This construction was mentioned at the meeting of the British Association in Dublin.—See the Reports of the Association, or London and Edinburgh Phil. Mag. vol. vii. p. 295. The following is an extract from the paper which I read at that meeting:—

"The formulæ given by Fresnel for the same purpose will be found to agree exactly with this rule, in determining the positions of the planes of polarisation; and his expression for the amplitude of the reflected vibration is also in accordance with our construction. But the coincidence does not hold with regard to the *amplitude* of the refracted vibration, though the *vis viva* of the refracted ray is the same in both theories.

"Now it is very remarkable that if we alter the hypotheses of Fresnel where they are at variance with the preceding principles, we shall, from his own equations of condition, deduce formulæ agreeing in every respect, even as to the amplitude of the refracted wave, with the construction which we have accounted for in a different way, (i. e. by using the relation among the pressures instead of the law of *vis viva*.) The requisite alterations are two in number. First, the vibrations are to be supposed parallel to the plane of polarisation, and not perpendicular to it, as Fresnel conceived; and secondly, the density of the ether is to be considered the same in both media, from which it follows, that the corresponding ethereal masses, imagined by Fresnel, are to each other as the sine of twice the angle of incidence to the sine of twice the angle of refraction. Substituting in Fresnel's equations of condition this value of the ratio of the masses, we obtain the formulæ which I am inclined to regard as correct."

The equations spoken of in this extract, are those which arise from the principle of *vis viva*, and from the equivalence of vibrations parallel to the separating surface of the two media. But it is worth while to observe, that when the vibrations are all in the same direction, that is, when the light is polarised perpendicular to the plane of incidence, the very same formulæ will come out from Young's remarkable analogy of the two elastic balls, one of which impinges directly on the other

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The reason of this construction will be evident, if we consider that, in an ordinary medium, the polar plane is the same as the plane of polarisation; and

supposed previously at rest, the masses of the balls being to each other in the ratio of the ethereal masses mentioned above. And, perhaps, this consideration affords the simplest possible explanation of Brewster's law relative to the polarising angle; for, as there is no reflected motion when the balls are equal, the whole velocity of impact being communicated to the ball that was at first quiescent, so there is no reflected vibration when the ethereal masses are equal; that is, when the sine of twice the angle of incidence is equal to the sine of twice the angle of refraction, or when the angles of incidence and refraction are together equal to a right angle. The whole of the incident vibration then passes into the refracted ray. In general, if i_1, i_2 denote the angles of incidence and refraction, the masses of the imaginary balls will be as $\sin 2i_1$ to $\sin 2i_2$; and, if the velocity of the original impact be taken for unity, the common theory of the collision of elastic bodies will give

$$\frac{\sin 2i_1 - \sin 2i_2}{\sin 2i_1 + \sin 2i_2} \quad \text{or} \quad \frac{\tan(i_1 - i_2)}{\tan(i_1 + i_2)}, \tag{i.}$$

for the velocity retained by the impinging ball after the impact; and

$$\frac{2\sin 2i_1}{\sin 2i_1 + \sin 2i_2} \quad \text{or} \quad \frac{\sin 2i_1}{\sin(i_1 + i_2)\cos(i_1 - i_2)}, \tag{ii.}$$

for the velocity communicated to the other ball. These expressions, (i.) and (ii.), are the same as the values of τ_s and τ_p, which we should deduce from equations (1) and (2), on the next page, by supposing τ_1 to be unity, and the angles θ_1, θ_2, θ_3 to be right angles. The general construction given in the text will lead to the same results, if we find from it the limiting ratios of the transversals, on the supposition that their directions approach each other indefinitely, and ultimately coincide in a right line perpendicular to the plane of incidence.

When the transversals are all in the plane of incidence, or when the light is polarised in that plane, the incident, the reflected, and the refracted transversals are to each other as $\sin(i_1 + i_2)$, $\sin(i_1 - i_2)$, and $\sin 2i_1$ respectively; because each transversal is proportional to the sine of the angle between the other two, and, in the present case, the angle between any two transversals is equal to the angle between the corresponding rays. Hence, taking the incident transversal for unity, the reflected transversal is

$$\frac{\sin(i_1 - i_2)}{\sin(i_1 + i_2)}, \tag{iii.}$$

and the refracted transversal is

$$\frac{\sin 2i_1}{\sin(i_1 + i_2)}. \tag{iv.}$$

It has been already observed, that our theory differs from that of Fresnel with regard to the magnitude of the refracted transversals. The expressions (ii.) and (iv.) must, in fact, be multiplied

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that, when there is only one refracted ray, the three transversals lie in the polar plane of that ray, according to the general remark with which we set out. We now proceed to show that the theorem asserted in this remark is a consequence of our hypotheses, and we shall afterwards deduce a few results which may be readily compared with experiments.

Let us suppose then that the direction of the incident transversal is such that there is only one refracted ray. It is evident that, in this case, the three transversals must lie in the same plane, since, by the fourth hypothesis, the refracted vibration is the resultant of the other two vibrations; and, therefore, we have only to prove that the plane of the transversals is the same as the polar plane of the refracted ray. Let τ_1, τ_2, τ_3 be the respective lengths of the incident, refracted, and reflected transversals; let θ_1, θ_2, θ_3 be the angles which they make with the plane of incidence, the angle θ_2 being known from the theory of Fresnel; put ι_1, ι_2, ι_3 for the angles made by the respective wave planes with the surface of the crystal, and m_1, m_2, m_3 for the relative quantities of ether set in motion by each wave. Then our hypotheses will give us the four following equations :—

$$m_1\tau_1^2 = m_2\tau_2^2 + m_3\tau_3^2, \tag{1}$$

$$\tau_1 \sin\theta_1 + \tau_3 \sin\theta_3 = \tau_2 \sin\theta_2, \tag{2}$$

$$\tau_1 \cos\theta_1 \cos\iota_1 + \tau_3 \cos\theta_3 \cos\iota_3 = \tau_2 \cos\theta_2 \cos\iota_2, \tag{3}$$

$$\tau_1 \cos\theta_1 \sin\iota_1 + \tau_3 \cos\theta_3 \sin\iota_3 = \tau_2 \cos\theta_2 \sin\iota_2. \tag{4}$$

The first equation is manifestly the translation of the law of the preservation of *vis viva*; the other three are obtained from the principle of equivalent vibra-

each by $\frac{\sin\iota_2}{\sin\iota_1}$, in order to produce the corresponding expressions which result from Fresnel's hypotheses.

But the two theories also differ as to the relative directions of the incident and reflected transversals. For, supposing the light to fall upon the denser medium, or ι_1 to be greater than ι_2, our construction indicates that these transversals, when the angle of incidence is small, point in the same direction; whereas Fresnel concludes the contrary to be the case. However, the disagreement in this respect ceases as we approach the limiting incidence of 90°; for then, according to both theories, the incident and reflected transversals point in opposite directions. This last conclusion is conformable to the inference which Professor Lloyd has drawn from his experiments on the interference of direct light with light reflected at a very oblique incidence.—See Irish Acad. Trans. vol. xvii. p. 176.

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tions, by resolving the vibrations, or transversals, in three rectangular directions. In the second equation, the transversals are resolved perpendicular to the plane of incidence; in the fourth, perpendicular to the surface of the crystal; and in the third equation they are resolved parallel to the intersection of these two planes. When the angles θ_1, θ_2, θ_3 begin, the transversals are in the plane of incidence in such a relative position, that if they were turned round together in that plane through a right angle, they would point each in the direction of its own wave's progress. These angles increase on the same side of the plane of incidence, and range through the whole circumference. The angles ι_1, ι_2, ι_3 are those of incidence, refraction, and reflexion; but, for the sake of symmetry, they are taken to be the angles which the wave normals, drawn from the origin in the direction of each wave's motion, make with the perpendicular to the surface, this perpendicular being directed towards the interior of the crystal. Thus it happens that ι_3 is the supplement of ι_1. Attending to this circumstance, equations (3) and (4) give us

$$\left.\begin{aligned} \tau_1\cos\theta_1-\tau_2\cos\theta_2&=\tau_3\cos\theta_3\,\frac{\cos\iota_3}{\cos\iota_1},\\ \tau_1\cos\theta_1+\tau_2\cos\theta_2&=\tau_3\cos\theta_3\,\frac{\sin\iota_3}{\sin\iota_1}; \end{aligned}\right\} \quad (5)$$

and by adding and subtracting these, we find

$$\left.\begin{aligned} \tau_1&=\tau_3\frac{\cos\theta_3}{\cos\theta_1}\,\frac{\sin(\iota_1+\iota_2)}{\sin2\iota_1},\\ \tau_2&=\tau_3\frac{\cos\theta_3}{\cos\theta_2}\,\frac{\sin(\iota_2-\iota_1)}{\sin2\iota_1}; \end{aligned}\right\} \quad (6)$$

which values if we substitute in equations (1) and (2), observing that $m_3=m_1$, as is evident, we shall get

$$\frac{\sin^2(\iota_1+\iota_2)}{\cos^2\theta_1}-\frac{\sin^2(\iota_1-\iota_2)}{\cos^2\theta_2}=\frac{m_2}{m_1}\frac{\sin^2 2\iota_1}{\cos^2\theta_2}, \quad (7)$$

$$\sin(\iota_1+\iota_2)\tan\theta_1-\sin(\iota_1-\iota_2)\tan\theta_2=\sin2\iota_1\tan\theta_2. \quad (8)$$

Subtracting from (7) the identity

$$\sin^2(\iota_1+\iota_2)-\sin^2(\iota_1-\iota_2)=\sin2\iota_1\sin2\iota_2,$$

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there remains

$$\sin^2(\iota_1+\iota_2)\tan^2\theta_1-\sin^2(\iota_1-\iota_2)\tan^2\theta_2=\frac{\sin^2 2\iota}{\cos^2\theta_2}\left(\frac{m_2}{m_1}-\frac{\sin 2\iota_2}{\sin 2\iota_1}\cos^2\theta_2\right); \quad (9)$$

and this, by making

$$\frac{m_2}{m_1}=\frac{\sin 2\iota_2+2h\sin^2\theta_2}{\sin 2\iota_1}, \quad (10)$$

becomes

$$\sin^2(\iota_1+\iota_2)\tan^2\theta_1-\sin^2(\iota_1-\iota_2)\tan^2\theta_2=\sin 2\iota_1(\sin 2\iota_2+2h)\tan^2\theta_2, \quad (11)$$

which is divisible by equation (8), the quotient being

$$\sin(\iota_1+\iota_2)\tan\theta_1+\sin(\iota_1-\iota_2)\tan\theta_2=(\sin 2\iota_2+2h)\tan\theta_2. \quad (12)$$

Then, by adding and subtracting equations (8) and (12), we obtain

$$\left.\begin{aligned}\tan\theta_1&=\cos(\iota_1-\iota_2)\tan\theta_2+\frac{h\tan\theta_2}{\sin(\iota_1+\iota_2)},\\ \tan\theta_2&=-\cos(\iota_1+\iota_2)\tan\theta_2+\frac{h\tan\theta_2}{\sin(\iota_1-\iota_2)}.\end{aligned}\right\} \quad (13)$$

These equations give the positions of the incident and reflected transversals when h is known.

Now let the directions in which the transversals have been resolved in equations (2), (3), (4), be taken for the axes of z, x, y respectively; so that, the origin being at O, the plane of xy may be the plane of incidence, and the axis of x may lie in the surface of the crystal. And, the reflected ray being conceived to lie within the angle made by the positive directions of x and y, let the initial condition that we have assumed for the angles θ_1, θ_2, θ_3 be satisfied by supposing that, when these angles begin, the transversals τ_1, τ_2 lie between the negative directions of x and y, and the tranversal τ_3 between the directions of $+x$ and $-y$. Then if θ_1, θ_2, θ_3 be reckoned towards the positive axis of z, so that each angle may be 90° when the corresponding transversal points in the direction of z positive, the equations of the transversal τ_1 will be

$$\frac{z}{\tan\theta_1}=-\frac{x}{\cos\iota_1}=-\frac{y}{\sin\iota_1}; \quad (14)$$

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and those of τ_3 will be

$$\frac{z}{\tan\theta_3}=\frac{x}{\cos\iota_3}=-\frac{y}{\sin\iota_3}. \tag{15}$$

Let

$$z+Ax+By=0, \tag{16}$$

be the equation of a plane passing through the directions of τ_1, τ_2 and τ_3. To determine A and B, let the variables be eliminated from this equation by means of (14) and (15) successively, and we shall get the two equations of condition,

$$\left.\begin{aligned}\tan\theta_1-A\cos\iota_1-B\sin\iota_1=0,\\ \tan\theta_2+A\cos\iota_1-B\sin\iota_1=0;\end{aligned}\right\} \tag{17}$$

which, by addition and subtraction, give

$$\left.\begin{aligned}B&=\frac{\tan\theta_1+\tan\theta_2}{2\sin\iota_1},\\ A&=\frac{\tan\theta_1-\tan\theta_2}{2\cos\iota_1};\end{aligned}\right\} \tag{18}$$

substituting, in these values, the expressions (13) for $\tan\theta_1$, $\tan\theta_2$, we have

$$\left.\begin{aligned}B&=\tan\theta_3\left(\sin\iota_3+\frac{h\cos\iota_3}{\sin^2\iota_1-\sin^2\iota_3}\right),\\ A&=\tan\theta_3\left(\cos\iota_3-\frac{h\sin\iota_3}{\sin^2\iota_1-\sin^2\iota_3}\right);\end{aligned}\right\} \tag{19}$$

whence, by making

$$\tan\kappa=\frac{h}{\sin^2\iota_1-\sin^2\iota_3}, \tag{20}$$

we find

$$\frac{B}{A}=\frac{\tan\iota_3+\tan\kappa}{1-\tan\iota_3\tan\kappa}=\tan(\iota_3+\kappa). \tag{21}$$

But if $z=0$ in (16), we have

$$Ax+By=0, \tag{22}$$

for the equation of the right line in which the plane of the transversals intersects the plane of incidence. This right line, lying, like the refracted wave

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normal, between the directions of $+x$ and $-y$, makes with the direction of $-y$ an angle υ which obviously has $\frac{B}{A}$ for its tangent; and therefore, by (21),

$$\upsilon = \iota_2 + \kappa; \tag{23}$$

which shows that the intersection of the two planes is inclined to the refracted wave normal at an angle equal to κ.

We must now find the value of h, which depends on the relative ethereal masses put in motion by the incident and refracted waves. Conceiving the incident and refracted rays to be cylindrical pencils, having of course a common section in the plane of xz, which is the surface of the crystal, let each pencil be cut by a pair of planes parallel to its wave plane, and distant a wave's length from each other; then the cylindrical volumes so cut out will represent the corresponding masses, since, by our second hypothesis, the densities are equal. These volumes are to each other in the compound ratio of their altitudes, which are the wave lengths, and of the areas of their bases. The altitudes are evidently as $\sin\iota_1$ to $\sin\iota_2$. The first base is a perpendicular section of the incident pencil; the second base an oblique section of the refracted one, the obliquity being equal to the angle ε at which the wave normal is inclined to the ray. The perpendicular sections are to each other as the cosines of the angles which they make with the common section of the cylinders, or as $\cos\iota_1$ to $\cos\iota_{(2)}$; putting $\iota_{(2)}$ for the angle which the refracted ray makes with the negative direction of y. The second base is greater than the perpendicular section of the refracted pencil in the proportion of unity to $\cos\varepsilon$. Therefore compounding all these ratios, we find

$$\frac{m_2}{m_1} = \frac{\sin\iota_2 \cos\iota_{(2)}}{\sin\iota_1 \cos\iota_1 \cos\varepsilon}. \tag{24}$$

The same result may be otherwise obtained by observing that, in a system of waves, the corresponding masses are proportional to the ordinates y of the points where the rays meet their wave surfaces. By a system of waves, I mean an incident wave with all that are derived from it by reflexion or refraction at the same surface of the crystal, or at parallel surfaces. If at the point where the incident ray intersects its spherical wave surface, we apply a tangent plane intersecting the plane of xz in a right line parallel to z, through which right line other planes are drawn touching the wave surface of the crystal in four points,

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these tangent planes will be the waves derived from the incident wave which touches the sphere; and the points of contact, including that on the sphere, will be the points where the rays meet the wave surfaces. Then the corresponding masses will be represented by prisms having a common rectangular base in the plane of xz, one side of this rectangle being the distance, on the axis of x, between the origin and the common intersection of the tangent planes; and the triangular face of each prism having the same distance for one side, and a point of contact for the opposite angle. These prisms, as they have a common base, will be proportional to their altitudes, which are the ordinates y of the points of contact. The expression (24) may be easily deduced from this relation.

Let OT, OP, and the negative direction of y meet the surface of the wave sphere (described with the radius OS) in the points T_s, P_s, Y_s; and let the right line, in which the plane of the transversals intersects the plane of incidence, meet the sphere in L_s. Then the points Y_s, P_s, L_s, being all in the plane of incidence, will be on the same great circle $Y_sP_sL_s$; and drawing the great circles T_sP_s, Y_sT_s, we shall have $Y_sP_s=\iota_s$, $Y_sT_s=\iota_{(s)}$, $T_sP_s=\epsilon$, $Y_sL_s=\upsilon=\iota_s+\kappa$, by (23); whence $P_sL_s=\kappa$.

As the transversal τ_s is perpendicular to the plane OTP, or to the plane of the great circle T_sP_s, the cosine of the spherical angle $T_sP_sY_s$ is the sine of θ_s; and therefore, from the triangle $T_sP_sY_s$, we have

$$\cos\iota_{(s)}=\cos\iota_s\cos\epsilon+\sin\iota_s\sin\epsilon\sin\theta_s, \tag{25}$$

which being substituted in (24), gives

$$\frac{m_2}{m_1}=\frac{\sin2\iota_s+2\sin^2\iota_s\sin\theta_s\tan\epsilon}{\sin2\iota_s}; \tag{26}$$

and comparing this result with (10), we find

$$h=\frac{\sin^2\iota_s\tan\epsilon}{\sin\theta_s}; \tag{27}$$

whence, and from (20), it follows that

$$\tan\kappa=\frac{\sin^2\iota_s\tan\epsilon}{(\sin^2\iota_s-\sin^2\iota_{(s)})\sin\theta_s}. \tag{28}$$

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Draw the great circle L_1K_1 at right angles to T_1P_1, and meeting it in K_1; then the plane of L_1K_1 will be the plane of the transversals, since the latter plane passes through L_1, and is perpendicular to T_1P_1. But the tangent of P_1K_1 is equal to the tangent of P_1L_1 multiplied by the cosine of the angle P_1 or by the sine of θ_2; therefore, denoting P_1K_1 by ϵ_1, and recollecting that $P_1L_1=\kappa$, we find, by (28),

$$\frac{\tan\epsilon_1}{\tan\epsilon}=\frac{\sin^2\iota_2}{\sin^2\iota_1-\sin^2\iota_2}. \tag{29}$$

Now we have seen that the ratio of OP to OS, or of OS to OG, is the index of refraction; so that $\sin^2\iota_1$ is to $\sin^2\iota_2$ as OP to OG. Therefore, by (29),

$$\frac{\tan\epsilon_1}{\tan\epsilon}=\frac{\mathrm{OG}}{\mathrm{OP}-\mathrm{OG}}=\frac{\mathrm{OG}}{\mathrm{GP}}; \tag{30}$$

but OG is to GP as the tangent of the angle GPT is to the tangent of the angle GOT; and since ϵ is the angle GOT, it follows that ϵ_1 is equal to the angle GPT or KOP. Consequently, OK will meet the surface of the sphere in the point K_1. Thus we have proved our assertion, that, *when there is only one refracted ray, the plane of the transversals is the polar plane of that ray.*

The sign of the quantity h is always the same as that of the cosine of the spherical angle $T_1P_1Y_1$. But to remove all ambiguity respecting signs, we must make a few additional conventions. Supposing, as we have hitherto done, that the refracted light moves from O to T, and conceiving a right line to be drawn from the origin parallel to GT, and directed from G towards T, let the angle $\Im_2$, which this right line makes with the plane of incidence, be reckoned, like θ_1, θ_2, from an initial position comprised between the negative directions of x and y; and let $\Im_2$, like the angles θ_1, θ_2, θ_3, increase on the side of z positive, and range from 0° to 360°. Then $\Im_2$ will always be equal either to the angle P_1 of the spherical triangle $T_1P_1Y_1$, or to the reentrant angle, which is the difference between P_1 and 360°. In either case, the cosine of $\Im_2$ will be the same, both in magnitude and sign, as the cosine of the angle $T_1P_1Y_1$. Consequently, if, instead of (25), we use the direct trigonometrical formula

$$\cos\iota_{(2)}=\cos\iota_2\cos\epsilon+\sin\iota_2\sin\epsilon\cos\Im_2, \tag{31}$$

we shall find

$$h=\frac{\sin^2\iota_2\tan\epsilon\cos\Im_2}{\sin^2\theta_3}; \tag{32}$$

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showing that the sign of h is always the same as the sign of $\cos\vartheta_g$. Now as θ_g differs from ϑ_g by a right angle, we will suppose

$$\theta_g = \vartheta_g + 90°, \tag{33}$$

and then we shall have $\sin\theta_g = \cos\vartheta_g$, algebraically as well as numerically. Thus we see that, by adopting these conventions, the value of h in (27) will have the proper sign. Therefore, substituting this value of h in formulæ (13), we obtain

$$\left.\begin{aligned} \tan\theta_1 &= \cos(\iota_1 - \iota_g)\tan\theta_g + \frac{\sin^2\iota_g \tan\epsilon}{\cos\theta_g \sin(\iota_1 + \iota_g)}, \\ \tan\theta_2 &= -\cos(\iota_1 + \iota_g)\tan\theta_g + \frac{\sin^2\iota_g \tan\epsilon}{\cos\theta_g \sin(\iota_1 - \iota_g)} \end{aligned}\right\} \tag{34}$$

These formulæ give the uniradial directions, or the positions of the incident and reflected transversals, when the sole refracted ray is that with which we have been occupied. The like directions, when the other ray exists alone, will be given by the formulæ

$$\left.\begin{aligned} \tan\theta'_1 &= \cos(\iota_1 - \iota'_g)\tan\theta'_g + \frac{\sin^2\iota'_g \tan\epsilon'}{\cos\theta'_g \sin(\iota_1 + \iota'_g)}, \\ \tan\theta'_2 &= -\cos(\iota_1 + \iota'_g)\tan\theta'_g + \frac{\sin^2\iota'_g \tan\epsilon'}{\cos\theta'_g \sin(\iota_1 - \iota'_g)}; \end{aligned}\right\} \tag{35}$$

where all the quantities, except ι_1, which remains the same, are marked with accents, to show that they belong to the second refracted ray.

The uniradial directions having been found by these equations, the relative magnitudes of the uniradial transversals are determined by equations (6). When the incident transversal is not uniradial, it is evident, as we said before, that it may be resolved* in the two uniradial directions; that each component transversal, as if the other component did not exist, will furnish a refracted ray and a partial

* That, if an incident transversal be resolved in any two directions, the reflected and refracted transversals arising from it will be the resultants of those which would arise from each of its components separately, is a principle which appears very evident, insomuch that we can hardly suppose it to be untrue, without doing violence to our physical conceptions. Nevertheless, it is necessary to prove that this principle is not contrary to the law of *vis viva*; for though the *vis viva* may be preserved by each set of components, (as it is when these are uniradial,) yet we cannot *therefore* con-

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reflected transversal uniradial in its direction; and that the total (or actual) reflected transversal will be the resultant of the two partial ones.

clude that it will be preserved by their resultants. Here then is a test of the consistency of our theory; for we are bound to show that the law of *vis viva* is not infringed by the adoption of the principle in question. Now it is easy to see that, whatever be the two directions in which the incident transversal is resolved, the final results will always be the same; because, taking the component in each of these directions separately, the reflected and refracted transversals belonging to it must be obtained, in the first place, by the help of a resolution performed in the uniradial directions. We need not, therefore, consider any case but that in which the resolution is uniradial throughout.

The incident transversal being denoted by τ_1, let τ_2 be the reflected transversal determined by the rules given in the text; and let the uniradial components of the former be τ_1, τ'_1, while those of the latter are τ_2, τ'_2. Then will

$$\tau_1^2 = \tau_1^2 + \tau'^2_1 + 2\tau_1\tau'_1\cos(\theta_1 - \theta'_1),$$
$$\tau_2^2 = \tau_2^2 + \tau'^2_2 + 2\tau_2\tau'_2\cos(\theta_2 - \theta'_2);$$

where the signification of θ_1, θ'_1, θ_2, θ'_2 is the same as in the text. The *vis viva* of one refracted ray is $m_1(\tau_1^2 - \tau_2^2)$, and that of the other is $m_1(\tau'^2_1 - \tau'^2_2)$; therefore the *vis viva* of both refracted rays is

$$m_1(\tau_1^2 + \tau'^2_1 - \tau_2^2 - \tau'^2_2),$$

a quantity which ought to be equal to

$$m_1(\tau_1^2 - \tau_2^2);$$

and consequently the equation

$$\tau'_1\tau'_2\cos(\theta_1 - \theta'_1) = \tau_2\tau'_2\cos(\theta_2 - \theta'_2) \qquad \text{(v.)}$$

ought to be true. This equation, by help of the expressions (6) for τ_1, τ_2, and the like expressions for τ'_1, τ'_2, becomes

$$\sin(i_1 + i_2)\sin(i_1 + i'_2)(1 + \tan\delta_1\tan\delta'_1) = \sin(i_1 - i_2)\sin(i_1 - i'_2)(1 + \tan\delta_2\tan\delta'_2); \qquad \text{(vi.)}$$

which again, by substituting the values (13) and the other similar values, is changed into

$$\sin(i_2 + i'_2)\{\cos(i_2 - i'_2) + \operatorname{cotan}\delta_2\operatorname{cotan}\delta'_2\} + h + h' = 0, \qquad \text{(vii.)}$$

where h' denotes for one refracted ray what h denotes for the other, the value of h being given by formula (27), and that of h' by the same formula with accented letters. The angle of incidence, we may observe, has disappeared from the equation.

If, therefore, the laws of reflexion, which we have endeavoured to establish, are consistent with each other, this last equation must be satisfied by means of the relations which the laws of propagation afford; or rather, the equation must express a property of the wave surface of the crystal, however strange it may be thought that such a property should be derived from the laws of reflexion, laws which would seem, at first sight, to have no connexion at all with the form of the wave surface. Now I have found that the equation (vii.) really does express a *rigorous* property of the biaxal wave surface

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When $\theta_2 = \theta'_2$, the partial reflected transversals will coincide, and their resultant will have a fixed direction, independent of the direction of the incident transversal. The angle of incidence at which this takes place is the polarising angle, and the common value of θ_2 and θ'_2 is the *deviation*. If, at the polarising angle, the partial reflected transversals be equal in magnitude, and opposite in direction, their resultant will vanish, and the reflected ray will disappear. This will happen when the incident transversal is in the plane of the two refracted transversals, and therefore in the intersection of this plane with the incident wave plane; for, when there is no reflected ray, the incident transversal alone must be equivalent to the two refracted transversals.

Since the reflected transversal can be made to vanish at the polarising angle, this angle might be found directly by putting the *vis viva* of the incident ray equal to the sum of the *vires vivæ* of the two refracted rays, and by making the incident transversal the resultant of the two refracted transversals. Resolving the transversals parallel to the axes of coordinates, these conditions would give four equations, from which we could eliminate the two ratios of the three transversals, together with the angle at which the incident transversal is inclined to the plane of incidence. In the equation produced by this elimination, the angle of incidence would be the polarising angle, and the other quantities would be known functions of that angle; whence the angle itself would be known.

It deserves to be remarked, that, at any angle of incidence, if the incident and reflected wave planes be intersected by a plane drawn through the two refracted transversals, the intersections will be corresponding transversal directions; that is to say, if the incident transversal coincide with one intersection, the reflected transversal will coincide with the other. For it is evident, from our fourth hypothesis, that if three of the transversals be in one plane, the fourth transversal must be in the same plane.

of Fresnel; a very curious fact, which not only shows that the laws of reflexion and the laws of propagation are perfectly adapted to each other, but also indicates that both sets of laws have a common source in other and more intimate laws not yet discovered. Indeed the laws of reflexion are not independent even among themselves; for the expressions (iii.) and (iv.) in the note on ordinary reflexion (page 43) have been deduced solely from the principle of equivalent vibrations, and yet they satisfy the law of *vis viva*. Perhaps the next step in physical optics will lead us to those higher and more elementary principles by which the laws of reflexion and the laws of propagation are linked together as parts of the same system.

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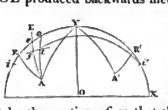
We come now to apply our theory to the case of uniaxal crystals; and, in doing so, we shall take the crystal to be of the *negative* kind, like Iceland spar, so that the ordinary refraction will be more powerful than the extraordinary. On the sphere described with the centre O and radius OS, let XY be a great circle in the plane of incidence, the radii OX, OY being the positive directions of the coordinate axes of x and y. Suppose the right lines iO and Oi', intersecting the sphere in i and i', to be the incident and reflected rays; let the ordinary refracted ray and the extraordinary wave normal be produced backwards from O to meet the sphere, at the side of the incident light, in the points o and e respectively; let the right line OA, cutting the sphere in A, be the direction of the axis of the crystal; and draw the great circles Ao, Ae, AY. The points i, e, o, i' are all on the circle XY. The point E, where the extraordinary ray OE produced backwards meets the sphere, will be on the circle Ae; and if, as in the figure, the arc Ae be less than a quadrant, the point e will lie between A and E. The polar plane of the ordinary ray is obviously the plane of the circle Ao; but the polar plane of the other ray must be found by a construction. On the arc AeE take the portion ef, so that the point e may lie between the points E and f, and so that the tangent of ef may be to the tangent of Ee as the square of the sine of the arc eY is to the difference between the squares of the sines of iY and eY. Through f draw the great circle fl perpendicular to the circle AeE; and it is manifest from (29) that the plane of fl is the polar plane of the extraordinary ray. On each circumference Ao and fl, the points which are distant 90° from i and i', the distances being measured by arcs of great circles, are the points where the uniradial transversals, prolonged from the centre, intersect the sphere. Let Ao and fl intersect each other in t, and let ti' be an arc of a great circle connecting the point t with the point i'. When the connecting arc ti' is a quadrant, the two uniradial transversals, belonging to the reflected ray, coincide with each other and with the right line Ot; the angle of incidence is then the polarising angle; the plane of ti' is the plane of polarisation of the reflected ray; and the angle ti'Y is the deviation.



To find the equations appropriate to uniaxal crystals, we may suppose formulæ (34) to belong to the ordinary, and formulæ (35) to the extraordinary ray.

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Then will $\iota = 0$, and $\iota' =$ the arc Ee. Putting θ and θ' for the spherical angles Aoi and Aei, we shall easily see that $\theta_2 = \theta + 180°$, and $\theta'_2 = \theta' + 90°$, if we conceive the point A and the positive axis of z to be both on the upper side of the plane XOY. And if ω' denote the arc Ae, while b and a respectively express the reciprocals of the principal indices, ordinary and extraordinary, the law of Huyghens, for the double refraction of uniaxal crystals, will give us

$$\tan \iota' = \frac{a^2 - b^2}{a^2} \sin \omega' \cos \omega', \tag{36}$$

where

$$s^2 = \frac{\sin^2 \iota'_2}{\sin^2 \iota_1} = b^2 + (a^2 - b^2) \sin^2 \omega'. \tag{37}$$

Observing these relations, we have, from (34),

$$\left.\begin{aligned} \tan \theta_1 &= \cos(\iota_1 - \iota_2) \tan \theta, \\ \tan \theta_2 &= -\cos(\iota_1 + \iota_2) \tan \theta, \end{aligned}\right\} \tag{38}$$

for the ordinary ray; and from (35) we get

$$\left.\begin{aligned} \tan \theta'_1 &= -\cos(\iota_1 - \iota'_2) \operatorname{cotan} \theta' - (a^2 - b^2) \frac{\sin \omega' \cos \omega' \sin^2 \iota_1}{\sin \theta' \sin(\iota_1 + \iota'_2)}, \\ \tan \theta'_2 &= \cos(\iota_1 + \iota'_2) \operatorname{cotan} \theta' - (a^2 - b^2) \frac{\sin \omega' \cos \omega' \sin^2 \iota_1}{\sin \theta' \sin(\iota_1 - \iota'_2)}, \end{aligned}\right\} \tag{39}$$

for the extraordinary ray.

The four preceding equations determine the uniradial directions; and the following equation,

$$\cos(\iota_1 + \iota_2) \tan \theta + \cos(\iota_1 + \iota'_2) \operatorname{cotan} \theta' - (a^2 - b^2) \frac{\sin \omega' \cos \omega' \sin^2 \iota_1}{\sin \theta' \sin(\iota_1 - \iota'_2)} = 0, \tag{40}$$

obtained by putting $\tan \theta_2 = \tan \theta'_2$, is that which determines the polarising angle.

In making use of this last equation to deduce the law of the polarising angles in various positions of the axis of the crystal, we shall confine ourselves to the case in which the reflexion from the crystal takes place *in air*, because the angle $\iota_1 - \iota'_2$ will then be considerable, and the quantities $\cos(\iota_1 + \iota_2)$ and $\cos(\iota_1 + \iota'_2)$ will be small, so that it will be easy to arrive at approximate results. For we shall have, in the first place,

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$$\cos(\iota_1+\iota'_2)=\cos(\iota_1+\iota_2)-(\iota'_2-\iota_2) \tag{41}$$

nearly, since $\iota_1+\iota_2$ will not differ much from a right angle; and because

$$\sin\iota_2=b\sin\iota_1, \quad \sin\iota'_2=s\sin\iota_1, \tag{42}$$

we shall also have, rigorously,

$$\sin^2\iota'_2-\sin^2\iota_2=(s^2-b^2)\sin^2\iota_1=(a^2-b^2)\sin^2\omega'\sin^2\iota_1, \tag{43}$$

or

$$\sin(\iota'_2-\iota_2)=(a^2-b^2)\frac{\sin^2\omega'\sin^2\iota_1}{\sin(\iota'_2+\iota_2)}, \tag{44}$$

which may be written

$$\iota'_2-\iota_2=(a^2-b^2)\frac{\sin^2\omega'\sin^2\iota_1}{\sin2\iota_2}, \tag{45}$$

with sufficient accuracy. This value of $\iota'_2-\iota_2$ having been substituted in (41), the resulting expression for $\cos(\iota_1+\iota'_2)$ must be substituted in equation (40), which will then become

$$\cos(\iota_1+\iota_2)(\tan\theta+\cot\theta)-(a^2-b^2)\sin^2\iota_1\sin\omega\left(\frac{\sin\omega\cot\theta}{\sin2\iota_2}+\frac{\cos\omega}{\sin\theta\cos2\iota_2}\right)=0, \tag{46}$$

if, denoting the arc Ao by ω, we confound ω' with ω, θ' with θ, and write $\cos2\iota_2$ instead of $\sin(\iota_1-\iota'_2)$. Multiplying all the terms of (46) by $\sin\theta\cos\theta$, we find

$$\cos(\iota_1+\iota_2)=(a^2-b^2)\sin^2\iota_1\sin\omega\cos\theta\left(\frac{\sin\omega\cos\theta}{\sin2\iota_2}+\frac{\cos\omega}{\cos2\iota_2}\right). \tag{47}$$

From A draw the arc AR meeting the arc $i'Y$ at right angles in the point R, and put $RY=p$, $AR=q$. Then by means of the values

$$\left.\begin{aligned}\cos\omega&=\cos q\cos(p-\iota_2),\\ \sin\omega\cos\theta&=\cos q\sin(p-\iota_2),\end{aligned}\right\} \tag{48}$$

afforded by the right angled triangle ARo, the equation (47) will take the form

$$\cos(\iota_1+\iota_2)=\frac{(a^2-b^2)\sin^2\iota_1}{\sin2\iota_2\cos2\iota_2}\cos^2q\sin(p-\iota_2)\sin(p+\iota_2), \tag{49}$$

or

$$\cos(\iota_1+\iota_2)=\kappa\cos^2q(\sin^2p-\sin^2\iota_2), \tag{50}$$

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where

$$\kappa = \frac{(a^2-b^2)(1+b^2)}{2b(1-b^2)}; \tag{51}$$

this value of κ being found by assuming $\tan\iota_1 = \operatorname{cotan}\iota_1 = b$, which is accurate enough for the purpose.

Thus we have obtained $\iota_1+\iota_2$, or the sum of the polarising angle and the angle of ordinary refraction. The former angle itself may be inferred from formula (50) by help of the relation $\sin\iota_2 = b\sin\iota_1$. In this way, if we use ϖ_1 instead of ι_1 to distinguish the polarising angle from other angles of incidence, and if we put

$$k = \frac{\kappa}{1+b^2} = \frac{a^2-b^2}{2b(1-b^2)}, \tag{52}$$

we shall find

$$\varpi_1 = \varpi - k\cos^2 q(\sin^2 p - \sin^2\iota_1), \tag{53}$$

in which ϖ is the angle whose cotangent is equal to b; in other words, ϖ is the polarising angle of an ordinary medium whose refractive index is equal to the ordinary index of the crystal.

This result accounts for a remarkable fact observed by Sir David Brewster, who, in the year 1819, led the way in the experimental investigation of the laws of crystalline reflexion. He found that the polarising angle remains the same when the crystal is turned round through 180°, though one of the angles of refraction is changed, and though the situation of the refracted rays, with respect to the axis of the crystal, becomes quite different from what it was. This circumstance, which surprised me when I first met with it, is an immediate consequence of formula (53); for the effect of a semi-revolution of the crystal is to change the signs of p and q; but the nature of the formula is such that these changes of sign do not alter the value of ϖ_1. Neither is that value altered by turning the crystal until the azimuth, as the spherical angle AYi is usually called, is changed into its supplement; for then the sign of p alone is affected.

Another remark, made by the same distinguished observer, is also a consequence of formula (53). From his experiments it appears that, on a given surface of the crystal, the polarising angle differs from a constant angle by a quantity proportional to the square of the sine of the azimuth AYi. Now

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calling this azimuth α, and putting λ for the acute angle at which the axis of the crystal is inclined to its surface, so that λ may be the complement of the arc AY, we have

$$\sin q = \cos\lambda \sin\alpha, \qquad \tan p = \operatorname{cotan}\lambda \cos\alpha; \tag{54}$$

and by making these substitutions in formula (53), after having changed $\sin\iota_2$ into $\cos\varpi$, that formula becomes

$$\varpi_1 = \varpi - k(\sin^2\varpi - \sin^2\lambda) + k\sin^2\varpi\cos^2\lambda\sin^2\alpha, \tag{55}$$

which agrees with the remark of Brewster.

The deviation θ_3 or θ'_3 is found from the second of equations (38), by putting $\frac{\tan q}{\sin(p-\iota_1)}$ for $\tan\theta$, and by substituting for $\cos(\iota_1+\iota_2)$ the value (49) or (50) which it has at the polarising angle. The result is

$$\theta_3 = \theta'_3 = -\frac{\kappa}{2}\sin 2q \sin(p+\iota_2), \tag{56}$$

since the small arc θ_3 may be taken for its tangent. This result is easily transformed into

$$\theta_3 = \theta'_3 = -\kappa \sin q \cos\phi, \tag{57}$$

where ϕ denotes the arc Ai, or the angle which the incident ray makes with the axis of the crystal; and this last expression is equivalent to the following,

$$\theta_3 = \theta'_3 = -\kappa\cos\lambda\sin\alpha(\sin\lambda\cos\varpi + \cos\lambda\sin\varpi\cos\alpha), \tag{58}$$

which gives the deviation in terms of λ and α.

As an example of the application of our formulæ, we shall make some computations relative to Iceland spar. According to M. Rudberg, the ordinary index of that crystal, for a ray situated in the brightest part of the spectrum, at the boundary of the orange and yellow, is 1.66; and the least extraordinary index for the same ray is 1.487. Dividing unity by each of these numbers, we get $a = .6725$, $b = .6024$; whence $\varpi = 58° 56'$; $k = .1164 = 6° 40'$; $\kappa = .1587 = 9° 5'$. Having thus determined the constants, we can readily calculate the polarising angle and the deviation, for any given values of λ and α.

First, let us see how the polarising angle varies on different faces of the crystal.

1. When $\lambda = 90°$, the face of the crystal is perpendicular to its axis, and ϖ_1 is independent of α. In this case, the formula (55) gives

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$$\varpi_1 = \varpi + k\cos^2\varpi = 60^\circ\,42',$$

which is the maximum value of the polarising angle.

2. When $\lambda = 0$, the axis lies in the face of the crystal, and formula (55) becomes

$$\varpi_1 = \varpi - k\sin^2\varpi\cos^2\alpha,$$

showing that $\varpi_1 = \varpi$, when α is either 90° or 270°. But when α is 0 or 180°, we have

$$\varpi_1 = \varpi - k\sin^2\varpi = 54^\circ\,2',$$

which is the minimum value of the polarising angle.

3. For the natural fracture-faces of the crystal the value of λ is $45^\circ\,23'$. Hence, when $\alpha = 0$ or 180°,

$$\varpi_1 = \varpi - k(\sin^2\varpi - \sin^2\lambda) = 57^\circ\,26';$$

and when $\alpha = 90^\circ$ or 270°,

$$\varpi_1 = \varpi + k\cos^2\varpi\sin^2\lambda = 59^\circ\,50'.$$

These values of the polarising angles agree very well with the experiments of Sir David Brewster, and still better with those of M. Seebeck.

If we wish to know in what azimuths ϖ_1 is equal to ϖ, on a given surface of the crystal, it is obvious from (55) that we must make

$$\sin^2\varpi - \sin^2\lambda = \sin^2\varpi\cos^2\lambda\sin^2\alpha,$$

whence we have, simply,

$$\cos\alpha = \pm\frac{\tan\lambda}{\tan\varpi}, \qquad (59)$$

which shows that the thing is impossible when λ is greater than ϖ; and that, when λ is less than ϖ, there are four such azimuths; as indeed there are, generally speaking, four values of α corresponding to any other particular value of the polarising angle. If α' be the least of these azimuths, the others will be $180^\circ - \alpha'$, $180^\circ + \alpha'$, and $360^\circ - \alpha'$. On a natural face of the crystal, the value of α', answering to the supposition $\varpi_1 = \varpi$, is found to be $52^\circ\,22'$.

Next, let us trace the changes which the deviation undergoes in some remarkable cases.

1. When the face of the crystal is perpendicular to its axis, there is evidently no deviation.

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2. When the axis lies in the face of the crystal, the deviation vanishes in the azimuths 0, 90°, 180°, 270°. In the intermediate azimuths, differing 45° from each of these, the deviation is a maximum; for if we put $\lambda = 0$ in formula (55) the result will be

$$\theta_1 = -\frac{\kappa}{2} \sin\varpi \sin 2\alpha;$$

and this quantity (neglecting its sign) is a maximum when $\sin 2\alpha = \pm 1$. The coefficient of $\sin 2\alpha$ is equal to 3° 54′, which is consequently the greatest value of the deviation. According to the experiments of M. Seebeck, the value is 3° 57′.

3. On the fracture-faces of the crystal, the deviation vanishes in the azimuths 0 and 180°, as also in two other azimuths for which

$$\cos\alpha = -\frac{\tan\lambda}{\tan\varpi},$$

and in which therefore ϖ_1 is equal to ϖ. In the azimuth 45° the deviation is − 3° 35′; in the azimuth 90° it is − 2° 32′; and in the azimuth 127° 38′ it vanishes; after which it attains a small maximum with a positive sign, and vanishes again in azimuth 180°. The calculated values of the deviation agree pretty well with the values observed by M. Seebeck.

The sign of the deviation shows at what side of the plane of incidence the plane of polarisation lies. But the position of the latter plane is best indicated by that of the transversal of the reflected ray. If this transversal and the axis of the crystal be produced from the origin, towards the same side of the plane of xz, until they intersect the sphere in the points t and A respectively, these points will be on the same side of the great circle XY when the deviation and the sine of the azimuth have unlike algebraic signs; and they will be on opposite sides of that circle when those quantities have like signs. Therefore if the crystal be supposed to revolve in its own plane, beginning at the azimuth 0, the points t and A will lie on the same side of XY until A reaches the position A′, where the angle A′Yt is equal to 127° 38′; the point t will then pass over to the side opposite A, at which side it will remain until A arrives at the azimuth 232° 22′. Thenceforward, to the end of the revolution, both points will be found on the same side of the circle XY.

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We have seen that the deviation always vanishes when the axis of the crystal lies in the plane of incidence. The reason is, because the crystal is then symmetrical on opposite sides of that plane. In this case the problem of reflexion offers peculiar facilities for solution, since the uniradial directions are obviously parallel and perpendicular to the plane of incidence. Let us therefore consider the case at length.

1. In the first place, when the only refracted ray is the ordinary one, the three transversals are in the plane of incidence, and the transversal of each ray is proportional to the sine of the angle between the other two rays. Hence the proportions are

$$\frac{\tau_1}{\sin(\iota_1+\iota_3)} = \frac{\tau_2}{\sin 2\iota_1} = \frac{\tau_3}{\sin(\iota_1-\iota_3)}, \tag{60}$$

the same as in ordinary media.

2. In the second place, when the sole refracted ray is the extraordinary one, the three transversals are perpendicular to the plane of incidence; and, if we use accents to mark the quantities connected with this ray, we have the equations

$$\left.\begin{aligned} \tau'_1+\tau'_2&=\tau'_3,\\ m_1\tau'^2_1&=m'^2_2\tau'^2_2+m_1\tau'^2_3, \end{aligned}\right\} \tag{61}$$

which give the proportions

$$\frac{\tau'_1}{m_1+m'_2} = \frac{\tau'_2}{2m_1} = \frac{\tau'_3}{m_1-m'_2}, \tag{62}$$

wherein

$$\frac{m'_2}{m_1} = \frac{\sin 2\iota'_2 \pm 2\sin^2\iota'_2\tan\epsilon'}{\sin 2\iota_1}, \tag{63}$$

by (26): the upper or lower sign being taken, in the numerator of (63), according as the refracted ray or its wave normal makes the smaller angle with a perpendicular to the face of the crystal.

To find the polarising angle, we have only to make $m_1=m'_2$, for then τ'_3 will vanish by (62); and therefore, if common light be incident, the whole reflected pencil will be polarised in the plane of incidence. Supposing the crystal to be a negative one, let us conceive the refracted ray to lie within the acute angle made by the axis of the crystal with a perpendicular to its surface. We shall then have to take the positive sign in the numerator of (63), and the polarising angle will be given by the condition

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$$\sin 2\iota_1 = \sin 2\iota'_2 + 2\sin^2\iota'_2 \tan\epsilon'. \tag{64}$$

But from (36) we have, in general,

$$\sin^2\iota'_2 \tan\epsilon' = (a^2 - b^2)\sin\omega'\cos\omega'\sin^2\iota_1, \tag{65}$$

and in the present instance it is evident that

$$\omega' = 90^\circ - \lambda - \iota'_2,$$

where λ denotes, as before, the angle which the axis of the crystal makes with its surface. Substituting these values in (64), and multiplying all the terms by $\tan\iota'_2$, we get

$$\sin^2\iota'_2 = \sin\iota_1\cos\iota_1\tan\iota'_2 - (a^2 - b^2)\sin(\lambda + \iota'_2)\cos(\lambda + \iota'_2)\tan\iota'_2\sin^2\iota_1.$$

Again, from (37) we have

$$\sin^2\iota'_2 = b^2\sin^2\iota_1 + (a^2 - b^2)\cos^2(\lambda + \iota'_2)\sin^2\iota_1; \tag{66}$$

and by equating these two expressions for $\sin^2\iota'_2$, we find

$$\tan\iota'_2 = \frac{a^2\cos^2\lambda + b^2\sin^2\lambda}{\operatorname{cotan}\iota_1 + (a^2 - b^2)\sin\lambda\cos\lambda}. \tag{67}$$

Then if this value of $\tan\iota'_2$ be substituted in equation (66), after all its terms have been divided by $\cos^2\iota'_2$, we shall obtain the simple and rigorous formula

$$\sin^2\iota_1 = \frac{1 - a^2\cos^2\lambda - b^2\sin^2\lambda}{1 - a^2b^2} = \sin^2\varpi_1, \tag{68}$$

for determining the polarising angle ϖ_1, when the axis of the crystal lies in the plane of incidence. It is manifest, from the nature of the formula, that this angle is the same, whether the azimuth is 0 or 180°; that is, whether the light is incident at the right or left side of the perpendicular to the surface of the crystal.

This formula might be deduced more briefly by recollecting what we have already proved, that the corresponding masses m_1 and m'_2 are proportional to the ordinates y of the points where the incident ray and the extraordinary refracted ray meet their respective wave surfaces; whence it follows, that these ordinates must be equal at the polarising angle; and thus the question is reduced at once to a geometrical problem. For as both rays are in the plane of incidence, the axis of x will be intersected in one and the same point by right lines touching the wave surfaces, or their sections, at the extremities of the ordinates. Now the

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sections in the plane of xy are a circle and ellipse with their common centre at the origin, the radius of the circle being unity, and the semiaxes of the ellipse being a and b, of which b is inclined at the angle λ to the axis of x; and therefore it is required to draw, parallel to the axis of x, a right line intersecting the circle and ellipse, so that if tangents be applied to them at two points of intersection which lie on the same side of the axis of y, these tangents, when produced, may cut each other on the axis of x. The angle which the tangent to the circle makes with the axis of x is then the polarising angle ϖ_1; and the solution of the problem just stated leads directly and easily to the formula (68). From this way of viewing the matter we see the reason why the polarising angle is the same in the azimuths 0 and 180°; for if tangents be applied at the two remaining points where the parallel that we have spoken of intersects the circle and ellipse, it is evident that these tangents also will cut each other on the axis of x; since tangents drawn at the extremities of any chord, either of a circle or an ellipse, intersect the parallel diameter at equal distances from the centre.

Let the reflecting surface of the crystal be in contact with a fluid medium whose index of refraction out of vacuo is represented by N, and let B and A respectively denote the ordinary and the principal extraordinary indices of refraction out of vacuo into the crystal. Then putting $\frac{N}{A}$ for a, and $\frac{N}{B}$ for b, in the preceding formula, and making

$$L^2 = A^2\sin^2\lambda + B^2\cos^2\lambda,$$

we readily deduce

$$\tan^2\varpi_1 = \frac{A^2B^2 - L^2N^2}{N^2(L^2 - N^2)}. \tag{69}$$

Hence we perceive that if $L^2 = AB$, that is, if

$$\tan\lambda = \sqrt{\frac{B}{A}},$$

(in which case λ will never be much above or below 45°,) the value of ϖ_1 will be always possible; for then we shall have

$$\tan^2\varpi_1 = \frac{AB}{N^2}. \tag{70}$$

But if λ be different from this, and of course L not equal to AB, the value of ϖ_1

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may become impossible for certain values of N. For it is clear that if N lie *between* the limits L and $\frac{AB}{L}$, the numerator and denominator of the fraction (69) will have unlike signs, and the tangent of ϖ_1 will be the square root of a negative quantity. In this case, therefore, if common light be incident, it will "refuse to be polarised," as Brewster expresses it; in other words, it will be impossible to find an angle of incidence at which the reflected peneil will cease to contain light polarised perpendieularly to the plane of incidence, or at whieh the reflected transversal τ'_3 will vanish. With all values of N, except those which are included between the narrow limits L and $\frac{AB}{L}$, the polarising angle is possible. It is zero at the latter limit, and 90° at the former. Outside these limits it changes rapidly at first, until N has passed either of them by a quantity considerable in proportion to the interval between them.

From (68) we find $\varpi_1=\lambda$, when $a=1$, or N=A; and also $\varpi_1=90°-\lambda$, when $b=1$, or N=B. In the latter ease it is remarkable that no light is reflected when common light is incident at the angle $90°-\lambda$. For then we have $\tau'_3=0$; and, because $\iota_1=\iota_2$, we have likewise $\tau_3=0$. Therefore no light can enter the refleeted peneil. But this case deserves that we should consider it more at large, without restricting ourselves to the supposition that the axis of the crystal lies in the plane of ineidence.

Assuming then that N=B, or that the refractive index of the fluid, which covers the reflecting surfaee, is equal to the ordinary index of the crystal itself, we may observe that, in this case, every angle of incidenee, in every azimuth, has a right to be regarded as a polarising augle. In fact, eommon light cannot suffer reflexion at the separating surface of the crystal and the fluid, without becoming completely polarised. For if polarised light be incident, and if τ_3 and τ'_3 be the uniradial reflected transversals, respeetively belonging to the ordinary and to the extraordinary ray, the former transversal must necessarily vanish, for the same reason that no reflexion can take place at the separating surface of two ordinary media whose refractive indices are equal; and thus the actual reflected transversal will always coincide in direction with τ'_3, whatever be the direction of the ineident transversal. Consequently, if common light be incident, the whole reflected pencil will be polarised in a plane passing though τ'_3, and making with

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the plane of incidence an angle θ'_2 determined by the second of formulæ (39). By putting $\iota_2 = \iota_1$ in that formula, and employing the expression (44), we first obtain

$$\tan\theta'_2 = \frac{\cos(\iota_1+\iota'_2)\cos\theta'\tan\omega' + \sin(\iota_1+\iota'_2)}{\sin\theta'\tan\omega'} = \frac{\cos(\iota_1+\iota'_1)\tan(p-\iota'_2)+\sin(\iota_1+\iota'_2)}{\sin\theta'\tan\omega'};$$

and thence

$$\tan\theta'_2 = \frac{\sin(p+\iota_1)}{\sin\theta'\tan\omega'\cos(p-\iota'_2)} = \frac{\sin(p+\iota_1)\cos\omega'}{\sin q\cos(p-\iota'_2)};$$

and finally,

$$\tan\theta'_2 = \sin(p+\iota_1)\operatorname{cotan} q; \qquad (71)$$

a result which shows that the plane of polarisation of the reflected ray is perpendicular to a plane drawn through the ray itself and the axis of the crystal.

Moreover, we find, from the first of formulæ (39), by proceeding as above,

$$\tan\theta'_1 = -\sin(p-\iota_1)\operatorname{cotan} q = -\operatorname{cotan}\theta; \qquad (72)$$

and from (38) it is evident that $\theta_1 = \theta$. Therefore all that relates to the case under our consideration may be summed up in the following statement:

When $\kappa = \kappa$, and the incident light is polarised in a plane passing through the axis, the course of the light is unaltered, and there is neither reflexion nor refraction. When it is polarised in the perpendicular plane, all the light which enters the crystal undergoes extraordinary refraction. Whatever light is reflected, is always polarised in a plane at right angles to that which passes through the reflected ray and the axis of the crystal; and this is true, whether the incident light is polarised or not.

Here, for the present, we must terminate our deductions from the general theory propounded in this paper. Several other questions remain to be discussed, such as the reflexion of common light* at the first surface, and the internal†

* The mode of treating the case in which common light is incident, has been pointed out at the bottom of p. 40.

† I have since found that the problem of reflexion at the second surface may be reduced to that of reflexion at the first surface, by means of a very simple rule. Let us suppose the two surfaces of the crystal to be parallel; and let a ray R_1, unradially polarised, and incident on the first surface, give the ray R_2 by reflexion, and the single ray R_3 by refraction. Let R_3 be the ray which suffers internal reflexion at the second surface, thereby giving the two reflected rays R_{11}, R'_{11}, and the single

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reflexion at the second surface of a crystal; but these must be reserved for a future communication. It would be easy, indeed, to write down the algebraical

refracted ray $\mathrm{R}_{(3)}$ emerging from the crystal in a direction parallel to R_1. Put τ_1, τ_2, τ_4, and τ_{11}, τ'_{11}, $\tau_{(3)}$ for the transversals of the rays in the order in which they have been named. As the transversal τ_4 is supposed to be given in magnitude, the lengths as well as the directions of τ, and τ_2 can be found by the construction in page 40.

Now, the direction of τ_2 being changed, and its magnitude retained, let the ray R_2 be turned directly back, so as to be incident again on the crystal, and to suffer reflexion and refraction at the first surface. Then the two refracted rays which it gives will be parallel to R_{11}, R'_{11}, and their transversals will be equal and parallel to τ'_{11}, τ'_{11}. The reflected ray which it gives will coincide with R_1; and the reflected transversal, when compounded with τ_4, will furnish a resultant equal and parallel to the emergent transversal $\tau_{(3)}$.

Thus the constructions, which have been given for the first surface, may be made available for the second surface, and every question relative to crystalline reflexion may be solved geometrically by means of the polar planes.

The foregoing rule was not, properly speaking, deduced from theory. I first formed a clear conception of what the rule ought to be, and then verified it for the simple case of singly refracting media, and finally proved it for doubly refracting crystals. The truth of the rule, in crystals, depends upon the truth of the three following equations:

$$\left.\begin{aligned}
&\sin(i_{11}+i'_{11})\,\{\cos(i_{11}-i'_{11})+\operatorname{cotan}\delta_{11}\operatorname{cotan}\delta'_{11}\}+h_{11}+h'_{11}=0,\\
&\sin(i_1-i_{11})\,\{\cos(i_4+i_{11})-\operatorname{cotan}\theta_4\operatorname{cotan}\theta_{11}\}+h_4-h_{11}=0,\\
&\sin(i_4-i'_{11})\,\{\cos(i_4+i'_{11})-\operatorname{cotan}\theta_4\operatorname{cotan}\theta'_{11}\}+h_4-h'_{11}=0,
\end{aligned}\right\}\qquad\text{(viii.)}$$

in which the notation is intelligible without any explanation. The first equation is the same as equation (vii.) already noticed; and the other two differ from it only in appearance, the change in the signs being occasioned by a change in the relative position of the rays.

When the reflexion is total, I suppose we may follow the example which Fresnel has set us in the case of ordinary media. The general algebraic expression for each reflected transversal will then become imaginary; and by putting it under the form

$$\tau\,(\cos\Phi+\sqrt{-1}\sin\Phi),$$

we shall have τ for the reflected transversal, and Φ for the change of phase.

From the nature of the rules which we have given for treating the question of reflexion at either surface of the crystal, it follows that the final equation, for determining the position of a transversal, is always linear, though the equation of the wave is of the second degree. This result very strongly confirms the theory; but it shows, at the same time, that the law of the preservation of the wave is not to be regarded as an ultimate principle, but rather as a consequence of some elementary law not yet discovered.

It now appears that the conjectures put forward in the note, p. 36, were hasty, and that there was some mistake in the calculations which gave rise to them. It is scarcely necessary to mention,

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solutions resulting from our theory; but this we are not content to do, because the expressions are rather complicated, and, when rightly treated, will probably contract themselves into a simpler form. It is the character of all true theories that the more they are studied, the more simple they appear to be. And we may add, that a close examination of such theories always meets with its reward, in the unexpected* consequences which present themselves to view. Nothing can

that the sheet in which that note is found was printed off before I had obtained the result announced in the subsequent note, p. 52. Various delays occurred while my paper was going through the press; and I took advantage of them to increase its value, by appending notes on some of the questions which I had overlooked or omitted in the first consideration of the subject.

* As an instance of this, it may be mentioned, that the conclusion arrived at in the note, p. 52, was wholly unexpected. And in verifying the equation (vii.), an unexpected and useful theorem was obtained; for it became necessary to find a manageable expression for the tangent of the angle ε which the wave normal makes with the ray. This expression is wanted in applying the formulæ (34) and (35) to biaxal crystals, and therefore I shall make no apology for introducing it here.

Having described a sphere concentric with the wave surface, let the wave normal OP and the two optic axes (which are the nodal diameters of the *index surface*,) be produced from the centre O to meet the sphere in the points P_1, A, A_1, respectively, thus marking out the angles of a spherical triangle P_1AA_1. The same wave normal may belong to two different rays; and if we select one of these rays, its transversal must lie in a plane drawn through the wave normal, and bisecting either the internal angle AP_1A_1 of the spherical triangle, or the external supplementary angle. By producing the optic axes in the proper directions, we may always make the above plane (which Fresnel calls the plane of polarisation) bisect the internal angle. Supposing this to have been done for the ray which was selected, put ω and ω_1 for the sides P_1A and P_1A_1 of the spherical triangle, and ψ for the contained angle AP_1A_1. Let s be the length of the wave normal from the centre O to the point where it intersects the tangent plane applied at the extremity of the ray, that is, applied at the point where the ray meets its own nappe of the wave surface; and let a and c be the greatest and least semiaxes of the ellipsoid which generates the wave surface. Then we shall have

$$\tan\varepsilon = \frac{a^2-c^2}{2\,s^2}\sin(\omega-\omega_1)\sin\tfrac{1}{2}\psi. \qquad \text{(ix.)}$$

And it is now manifest that if ε_1 be the angle which the other ray makes with the same wave normal, and s_1 the length of the wave normal intercepted between the centre and the tangent plane at the extremity of this ray, we shall also have

$$\tan\varepsilon_1 = \frac{a^2-c^2}{2\,s_1^2}\sin(\omega+\omega_1)\cos\tfrac{1}{2}\psi. \qquad \text{(x.)}$$

If a ray is given in direction it will have two wave normals; and then the angles ε, ε_1, which it makes with each normal may be found from the formulæ

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be simpler than the laws of double refraction, as they were delivered by Fresnel; yet the properties of his wave surface still continue to furnish the geometer with beautiful and curious relations. So we may hope that a little more time, devoted to the laws of reflexion, will not be spent in vain. They promise to supply many other theorems, not undeserving of attention, though perhaps not as simple and comprehensive as those that have already been made known.

If we are asked what reasons can be assigned for the hypotheses on which the preceding theory is founded, we are far from being able to give a satisfactory answer. We are obliged to confess that, with the exception of the law of *vis viva*, the hypotheses are nothing more than fortunate conjectures. These conjectures are very probably right, since they have led to elegant laws which are fully borne out by experiments; but this is all that we can assert respecting them. We cannot attempt to deduce them from first principles; because, in the theory of light, such principles are still to be sought for. It is certain, indeed, that light is produced by undulations, propagated, with transversal vibrations, through a highly elastic ether; but the constitution of this ether, and the laws of its connexion (if it has any connexion) with the particles of bodies, are utterly unknown. The peculiar mechanism of light is a secret that we have not yet been able to penetrate. As a proof of this, we might observe, that some of the simplest and most familiar phenomena have never been explained. Not to mention dispersion, about which so much has been fruitlessly written, we may remark, that the very cause of ordinary refraction, or of the retardation which light undergoes upon entering a transparent medium, is not at all understood. Much less can it be said that double refraction has been rigorously explained; its laws alone have been clearly developed by Fresnel. In short, the whole amount of our knowledge, with regard to the propagation of light, is confined to the *laws* of phenomena; scarcely any approach has been made to a mechanical theory of those laws. And if the

$$\left.\begin{aligned} \tan\varepsilon &= \frac{r^2}{2}\left(\frac{1}{c^2}-\frac{1}{a^2}\right)\sin(\omega-\omega_1)\sin\tfrac{1}{2}\psi, \\ \tan\varepsilon_1 &= \frac{r_1^2}{2}\left(\frac{1}{c^2}-\frac{1}{a^2}\right)\sin(\omega+\omega_1)\cos\tfrac{1}{2}\psi, \end{aligned}\right\} \qquad \text{(xi.)}$$

where r and r_1 are the two radii of the wave surface which are in the direction of the ray; the spherical triangle P_1AA_1, of which the sides and contained angle are expressed by the same letters as before, being now formed by producing the *ray* and the two nodal diameters of the *wave surface*, until they intersect the sphere in the points P_1, A, A_1.

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case of uninterrupted propagation through a continuous medium presents such difficulties, it would be useless to think of accounting for the laws which subsist at the confines of two media, where the continuity is broken.

But perhaps something might be done by pursuing a contrary course; by taking those laws for granted, and endeavouring to proceed upwards from them to higher principles. In this point of view, our second law, or hypothesis, is extremely remarkable; for it seems to be opposed, in some degree, to the notion that the ethereal molecules are strongly attracted or repelled by the particles of bodies. However that may be, it would appear that a true theory must be in accordance with this hypothesis; and that any mechanical ideas, which would make the *mean* density of the ether vary from one medium to another, cannot be admitted to represent the real state of things in nature.* It is no objection to the hypothesis in question, to say that it increases the difficulty of accounting for refraction; for, as there is positive evidence in favour of the hypothesis, we ought rather to conclude that the common opinion, which attributes refraction to a change of density in the ether, is altogether erroneous.

In the next place we may remark, that our first hypothesis,† concerning the direction of vibrations in polarised light, will be useful in testing any proposed theory; for as it now seems to be certain that the vibrations are parallel to the plane of polarisation, and not perpendicular to it, as Fresnel supposed, such a direction of the vibrations ought to be a consequence of the theory which we adopt.

The third hypothesis, or the principle of the preservation of *vis viva*, is the most natural that can be imagined, inasmuch as it implies only this, that the incident light is equal to the sum of the reflected and refracted lights. Yet it is probable that even this principle, like the law of *vis viva* in ordinary mechanics, is a result of simpler laws, and will be shown to be so, as soon as the true mechanism of light shall be discovered.

The fourth hypothesis is a very important one, because the whole theory turns

* Those who maintain that the density of the ether is different in different media, ought to consider the following question:—What function of the three principal indices of a doubly refracting crystal, represents the density of the ether within the crystal?

† This hypothesis properly belongs to the laws of propagation, as it relates only to what passes within a given medium.

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upon it; and therefore, in the beginning of this paper, a particular account has been given of the manner in which it was originally suggested. If we wished to give a reason for this hypothesis, we might say, that the motion of a particle of ether, at the common surface of two media, ought to be the same, to whichsoever medium the particle is conceived to belong; and as the incident and reflected vibrations are superposed in one medium, and the refracted vibrations in the other, we might infer that the resultant of the former vibrations ought to be the same, both in length and direction, as the resultant of the latter. At first sight this reasoning appears sufficiently plausible; but it will not bear a close examination. For as the argument is general, it would prove that the principle of the equivalence of vibrations is true for metals,* as well as for crystals, which it certainly is not.

* A few days after this paper was read, I found reason to persuade myself, that, in metals, the vibrations parallel to the surface are equivalent, but not those perpendicular to it; and that, in metals as well as in crystals, the *vis viva* is preserved. This persuasion was founded on a system of formulæ which I had invented for expressing the laws of metallic reflexion and refraction; and which seem to represent very satisfactorily the experiments of Brewster, Phil. Trans. 1830. As metallic and crystalline reflexion are kindred subjects, and will one day be brought under the same theory, however distinct they may now appear, it will not be out of place to insert the formulæ for metals here. These formulæ are not proposed as true, but as likely to be true; and they will be found to express, at least with general correctness, all the circumstances that have hitherto been regarded as anomalies in the action of metals upon light.

I suppose that, for every metal, there are two constants, M and χ, of which the first is a number greater than unity, and the second is an angle included between 0 and 90°. The number M I call the *modulus*, and the angle χ the *characteristic* of the metal. Both M and χ vary with the colour of the light, and the ratio $\frac{M}{\cos\chi}$ is probably the index of refraction. From Brewster's experiments it appears that M diminishes from the red to the violet; and therefore I should suppose that $\cos\chi$ diminishes in a greater ratio, in order that the index of refraction may increase as in transparent substances.

Put i_1 for the angle of incidence, and i_2 for the angle of refraction, so that

$$\frac{\sin i_1}{\sin i_2} = \frac{M}{\cos\chi}; \tag{xii.}$$

and let μ be a variable determined by the condition

$$\mu = \frac{\cos i_1}{\cos i_2}. \tag{xiii.}$$

These two relations combined will give

$$\frac{1}{\mu^2} = 1 + \left(1 - \frac{\cos^2\chi}{M^2}\right)\tan^2 i_1, \tag{xiv.}$$

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It is not easy to see why the principle should hold in the one case, and not in the other; but it is probably prevented from holding, in the case of metals, by the

which shows that μ is equal to unity at a perpendicular incidence, and that it vanishes at an incidence 90°, decreasing always during the interval.

Now if plane polarised light be incident on the metal, we must distinguish two principal cases, according as the light is polarised in the plane of incidence, or in the perpendicular plane. In the first case, denoting the reflected and refracted transversals by τ_p and τ, respectively, let us put Δ_p for the change of phase in the reflected ray, and Δ_s for the change of phase in the refracted ray. Let the same symbols, marked with accents, be used in the second case with similar significations. Then if the incident transversal be taken for unity, we shall have the following formulæ:

1. When the incident transversal is in the plane of incidence,

$$\left.\begin{aligned} \tau_p^2 &= \frac{\mathrm{M}^2+\mu^2-2\mathrm{M}\mu\cos\chi}{\mathrm{M}^2+\mu^2+2\mathrm{M}\mu\cos\chi}, \\ \tau_s^2 &= \frac{4\mathrm{M}^2\mu^2}{\mathrm{M}^2+\mu^2+2\mathrm{M}\mu\cos\chi}, \\ \tan\Delta_p &= \frac{2\mathrm{M}\mu\sin\chi}{\mathrm{M}^2-\mu^2}, \qquad \tan\Delta_s = \frac{\mu\sin\chi}{\mathrm{M}+\mu\cos\chi}. \end{aligned}\right\} \quad (\text{xv.})$$

2. When the incident transversal is perpendicular to the plane of incidence,

$$\left.\begin{aligned} \tau'^2_p &= \frac{1+\mathrm{M}^2\mu^2-2\mathrm{M}\mu\cos\chi}{1+\mathrm{M}^2\mu^2+2\mathrm{M}\mu\cos\chi}, \\ \tau'^2_s &= \frac{4\mathrm{M}^2\mu^2}{1+\mathrm{M}^2\mu^2+2\mathrm{M}\mu\cos\chi}, \\ \tan\Delta'_p &= \frac{2\mathrm{M}\mu\sin\chi}{\mathrm{M}^2\mu^2-1}, \qquad \tan\Delta'_s = \frac{\sin\chi}{\mathrm{M}\mu+\cos\chi}. \end{aligned}\right\} \quad (\text{xvi.})$$

When $\chi=0$, there is no change of phase, and the formulæ become identical with those given in the note, p. 43. When $\chi=90°$, there is total reflexion at all incidences. The case of pure silver approximates to this. For good speculum metal, χ is about 70°. The value of M ranges from $2\frac{1}{2}$ to 5 in different metals.

When the incident transversal is inclined to the plane of incidence, its components, parallel and perpendicular to that plane, will give two reflected transversals with a difference of phase equal to $\Delta'_s-\Delta_s$. The reflected vibration will then be performed in an ellipse; and the position and magnitude of the axes of the ellipse may be deduced from the preceding formulæ. The consequences of these formulæ are very simple and elegant, but I cannot dwell upon them here. Suffice it to observe, that every angle of incidence has another angle corresponding to it, which I call its *conjugate* angle of incidence; and that the value of $\Delta'_s-\Delta_s$ at one of these angles is the supplement of its value at the other, while the ratio $\frac{\tau'_s}{\tau_s}$ is the same at both angles; whence it follows that, *ceteris paribus*, the elliptic vibrations, reflected at conjugate angles, are similar to each other, and have their homologous axes equally inclined to the plane of incidence, but on opposite sides of it. When

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same cause, whatever it is, which produces a change of phase in metallic reflexion.

It will be proper to conclude this Essay with a brief sketch of the researches of Sir David Brewster and M. Seebeck, the only other writers who have treated of the subject of crystalline reflexion.

So early as the year 1819, Sir David Brewster published, in the Philosophical Transactions, a paper "On the Action of Crystallized Surfaces upon Light."* In this paper the author details a great variety of experiments on the polarising effects of Iceland spar. He gives the measures of the polarising angles in different azimuths, when the reflexion takes place in air; but he does not notice the accompanying deviations, which were probably too small to attract his attention. In another instance, however, he obtained very large deviations. He conceived the idea of pushing his experiments into an extreme case, by masking, as it were, the ordinary reflecting action of the crystal, and leaving the extraordinary energy at full liberty to display itself. This was done by dropping on the reflecting surface a little oil of cassia, a fluid whose refractive index is nearly equal to the ordinary index of Iceland spar. When common light, incident at 45°, was reflected at the separating surface of the oil and the spar, the reflected pencil was found to be partially, and sometimes completely, polarised in planes variously inclined to the plane of incidence, the inclination going through all magnitudes from 0 to 180°, as the crystal was turned round in azimuth. This general result is no more than what theory would lead us to expect, when the angle of incidence is nearly equal to one of the angles of refraction; but, to institute a minute comparison of theory with experiment, would require troublesome calculations, which I have not had time to make. With the view, however, of showing clearly, from theory, that the range of the deviation is unlimited, I have considered the simple case in which $N = B$, or in

$\Delta'_1 - \Delta_1 = 90°$, the conjugate incidences are equal, the ratio $\frac{r'_1}{r_3}$ is a minimum, and the axes of the elliptic vibration are parallel and perpendicular to the plane of incidence. When $\Delta'_1 = 90°$, or $M\mu = 1$, the value of r', is a minimum, and equal to $\tan \frac{1}{2}\chi$.

The foregoing formulæ differ slightly from those which I have given in No. I. of the Proceedings of the Royal Irish Academy. The small quantity χ', which occurs in the latter, has been purposely neglected, as its presence interferes with the simplicity of the expressions.

* Phil. Trans. 1819, p. 145.

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which the refractive index of the fluid is *exactly* equal to the ordinary index of the crystal. This case, moreover, is remarkable on its own account; and it might be worth while to try whether it could not be verified by direct experiment. If a fluid could be procured, whose refractive index, for some definite ray of the spectrum, should be equal to the ordinary index of the crystal for the same ray, and if common light, incident at any angle and in any azimuth, were reflected at the confines of the fluid and the crystal, then, supposing the theory to be exact, the definite ray aforesaid would, as we have seen, be completely polarised by reflexion, and the plane of polarisation would always be perpendicular to a plane drawn through the direction of the reflected ray and the axis of the crystal. This experiment would be an elegant test of the theory in its application to these extreme and trying cases; and if it were successful, no doubt could be entertained* as to the rigorous accuracy of the geometrical laws of reflexion.

* I was at this time in doubt whether the phenomena observed with oil of cassia could be reconciled to theory, and when the note in page 36 was written, I was almost certain that they could not. But I have since, I think, found out the cause of this perplexity. Some of Brewster's experiments were made with *natural* surfaces of Iceland spar; others with surfaces *artificially polished*. I believe (though I have made very few calculations relative to the point) that the former class of experiments will be perfectly explained by the theory; the latter I am certain cannot be so explained, nor ought we to expect that they should. For the process of artificial polishing must necessarily occasion small inequalities, by exposing little elementary rhombs with their faces inclined to the general surface; and the action of these faces may produce the *unsymmetrical* effects which Brewster notices as so extraordinary (Sixth Report of the British Association, Transactions of the Sections, p. 16). If this will not account for such effects, I do not know what will. From an old observation of Brewster (Phil. Trans. 1819) it would appear, that imperfect polish does actually produce a want of symmetry in the phenomena; for when common light was reflected between oil of cassia and a badly polished surface *perpendicular* to the axis, he found that the reflected ray was polarised neither in the plane of incidence, nor perpendicular to it, but 75° out of it. The same surface, when the light was reflected in air, gave the polarising angle more than two degrees below its proper value.

To show that, in other respects, the general character of the phenomena is in accordance with theory, we may observe that, when $N = B$, and $\lambda = 0$ or 90°, if common light be incident at 45° in the plane of the principal section of the crystal, the whole of the reflected light will be polarised perpendicularly to that plane; and therefore if N be *nearly* equal to B, while every thing else remains the same, the reflected pencil will contain some unpolarised light, and will be only partially polarised in a plane perpendicular to the plane of incidence; so that (as Brewster has found by experiment) the crystal will then produce by reflexion the same effect which is produced by ordinary refraction. This (as he also found) will not happen when λ and the angle of incidence are each equal to 45°; because the light is then incident at the polarising angle.

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The experiments with oil of cassia must be very difficult, on account of the great feebleness of the reflected light. Sir David Brewster, however, resumed them at different times; and he laid an extensive series of his results before the Physical Section of the British Association at its late meeting in Bristol.

It was not until the latter end of November, 1836, that I became acquainted with the investigations of M. Seebeck, who has contributed greatly to the advancement of the subject. He made very accurate experiments on the light reflected in air from Iceland spar. He detected the deviation, notwithstanding its smallness, and measured it with great care. He also made the first step in the theory of crystalline reflexion; and the remarkable formula (68), which gives the polarising angle when the axis lies in the plane of incidence, is due to him. The hypotheses which he employed were similar to those of Fresnel, and they enabled him to solve the problem of reflexion in the case just mentioned, but not to attempt it generally. The date of his first papers* is the year 1831; but he did not publish his experiments on the deviation until a recent occasion, when he was led to compare them† with the theory which I had originally given in my letter to Sir David Brewster. I have already stated the correction‡ which the theory underwent in consequence of those experiments, and by which it was brought to its present simple form.

* Poggendorff's Annals, vol. xxi. p. 290; vol. xxii. p. 126. † Ibid. vol. xxxviii. p. 280.

‡ Two or three months after this correction had been published in the Philosophical Magazine, a notice of it was inserted in Poggendorff's Annals, vol. xl. p. 462. Up to that time, I believe, nothing had been published in Germany on the general theory of crystalline reflexion; at least the writer of the notice (whom I take to be M. Seebeck) does not seem to have heard of any other theory, or any other principles, than mine. But in the next number of Poggendorff, vol. xl. p. 497, there appeared a letter from M. Neumann, in which the writer speaks of a theory of his own, founded on principles exactly the same as those which I had already announced, and refers to a paper which he had communicated on the subject to the Academy of Berlin. The paper has been printed in the Transactions of that Academy for the year 1835; and through the kindness of the author I have received a copy of it, just in time to acknowledge it here. On casting my eye over it, I recognise several equations which are familiar to me; in particular, the equations (vii.), (viii.), (ix.), (x.), which I discovered independently in November last. M. Neumann's paper is very elaborate, and supersedes, in a great measure, the design which I had formed of treating the subject more fully at my leisure; nor can I do better than recommend it to those who wish to pursue the investigations through all their details.

Trinity College, Dublin, *March*, 1838.

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IV. *On a hitherto unobserved Structure discovered in certain Trap Rocks in the County of Galway.* *By* Robert Mallet, Esq., M.R.I.A.

Read 10th April, 1837.

THE town of Galway is built upon part of a vast mass of trap rock, lying in, and forming the embouchure of Lough Corrib, and which, running in a direction nearly N. N. E., is lost beneath the sea in Galway bay at one end, and towards the other may be traced to a considerable distance along the western shores of the lake. This immense deposit appears to be a trap-dyke of the largest class; it separates the mountain-limestone of Galway and the neighbouring counties, on the east, from the sienite of Cunnemara on the west.

The limestone, at its junction with the trap, when not covered and obscured by the sea or alluvial matter, is *tilted* up; the otherwise nearly level strata making angles of about eighteen degrees with the horizon. At one of these places, namely, in the demesne of Renville, near Oranmore, about four miles from Galway, a vein of cubical galena has been discovered, which offers a favourable prospect to the miner, much "gossan" forming the "crop" of the vein. The direction of the vein is nearly perpendicular to that of the trap-dyke.

The trap appears on the other side chiefly to overlie the sienite; but in some places it mingles with it, as though by fusion in almost insensible degrees. Both on the limestone and sienite sides, masses of each of these rocks are found enveloped in the trap;—the limestone being much altered in hardness and colour, its specific gravity and size of crystalline grain increased, and the rock occasionally converted into something allied to basanite or Lydian stone.

The existence of these imbedded masses of each of the neighbouring rocks, with their alteration of character, and the *tilting* up of the limestone strata, would seem to confirm the opinion that this deposition is a true trap-dyke. The

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occurrence of limestone imbedded in trap is unusual. Kirwan, however, mentions that the "variolites" of Drac contain rounded masses of limestone and steatite.

Considerable excavations for a new dock, covering eight acres, are now in progress at Galway, and afford ample opportunity of examining the intimate structure of the trap rock. Its general surface, where laid bare, is about twelve feet above low water mark; it is rough, vesicular, and apparently water-worn, and rises every where into irregular "hummocks." The mass of the rock consists of greenstone of a dark leek-green colour, passing into purplish gray; rather fine-grained, and softer than usual, yielding, with difficulty, a whitish streak with steel. It absorbs water slightly, and becomes very dark-coloured when wet; is sonorous when in thin pieces; and has an average specific gravity of 2.87; its fracture is uneven, and sometimes imperfectly conchoidal. Its texture and colour are however extremely various, veins of several different constituents continually occurring in it, mixed and contorted in the most capricious manner—a single hand specimen often containing red granite and greenstone, passing into and varied in every possible way by hornblende, augite, schorl, albite, felspar, olivine, &c. Nearly in the centre of the surface of the rock exposed by excavation, there occurs a great vein of white hornstone rising with its laminæ vertical, and in something of a pyramidal form, in the midst of the trap. Its structure is lamellar, or pseudo-crystalline, with some perpendicular rifts; its substance is perfectly uniform, containing no imbedded minerals; its texture very hard and porcellaneous, with a high specific gravity; the longitudinal fracture slaty, and cross fracture splintery. At the surfaces of contact it is accurately moulded to the trap, but no where adherent to it. It appears to have been ejected after, and through the dyke itself, and is probably formed from simpler rocks, possibly slate, at a much greater depth.*

The minerals found imbedded in this trap-dyke are many and various. The following have been already collected, and others probably remain for future explorers:—

Mica,—brown and white, rarely.

Felspar,—in brown, red, and white crystals.

Albite,—large crystals in sienite, and druses in the hornstone.

* This hornstone has since been found to afford an excellent substitute for the costly "Turkey whetstones."

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Olivine,—massive, and in small crystals.

Augite, *Amphibole*, *Epidote*,—in fine crystals; the latter also found on Mutton Island.

Apatite,—in microscopic crystals.

Chlorite,—indurated.

Adularia, *Chalcedony*,—met with only in small specimens.

Sulphate of Lime,—probably "*anhydrite*."

Baryto-calcite,—crystallized in large masses.

Arragonite.

Calcareous Spar.

Fluor Spar,—in purple cubic crystals, along with

Galena,—in cubes.

Iron Pyrites,—sometimes magnetic.

Specular Iron Ore,—in minute octahedral crystals.

A few of these minerals are rare in any habitat, others rare as occurring in trap rock. Of these fluor has hitherto been found in trap only in two instances, —at Gourock, in the Frith of Clyde, and at Papa Stour, one of the Shetlands. Anhydrous sulphate of lime has been found in a trap-dyke at Cave Hill, near Belfast.

Epidote is found in unusually fine crystals, imbedded in a red ochrey clay (apparently of decomposed trap) on Mutton Island, in Galway Bay, the site of the light-house. The island is low, and consists of sienite and trap, with a shingle beach of those rocks and limestone pebbles intermixed; epidote being also found in rolled pieces.

The iron pyrites is massive, and in crystals more or less perfect. The crystals appear to be hexagonal prisms, always imbedded, and sometimes magnetic.

By far the most singular circumstance, however, connected with this dyke, is the fact, that it possesses very generally a hidden nodular structure, of a description different from that hitherto found in any rock.

When a mass of this rock is separated by *the hammer*, it always breaks with the kind of fracture before described, and no trace of any thing unusual can be found. But in the process of *blasting*, the lines of least resistance in the mass seem to be discovered by the expansive force with a beautiful precision, and the fragments are found consisting of single or cohering nodules of trap, of various

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sizes, imbedded in a matrix of a material similar to their own;—the texture, cohesion, colour, and frangibility, &c. of the nodule and matrix being so precisely alike, that when two or more nodules are found cohering, on being struck with a hammer they will as readily break through as separate. So entirely identical is the structure of the nodules and matrix, that the existence of the former could never have been ascertained or suspected without the aid of blasting; bringing to mind the ancient Grecian fable of the statue hidden in the yet unhewn block, revealed by the sculptor's chisel.

This nodular structure is confined to the more uniform portions of the dyke; or, if it ever existed in the more complex and variegated parts, it appears to have been obliterated by more perfect fusion,—many of the veined and compound specimens presenting the appearance of having *flowed* in a state of perfect fluidity.

The nodules are from eighteen inches in diameter to the size of a hazel nut; and the nodule and its seat, or nidus, may frequently be found and fitted together. They are usually pretty close together, and sometimes appear to have been pressed into actual contact,—their sides being flattened one against the other, and their surfaces of separation irregularly multilateral, like those of coherent bubbles of a mucilaginous fluid.

Many of the nodules present distinct indications of magnetic polarity. When an imbedded crystal (as of pyrites) occurs in a nodule, at its surface, it is always *limited by the latter*, or moulded to, and rendered imperfect by the matrix, and *vice versa;* no instance occurring of a crystal running from one into the other.

Foreign matter is in general much rarer in the nodule than in the matrix, and rarer in those parts of the dyke which possess the nodular structure, than in those which do not,—namely, the veined and variegated portions. In some cases the nodular structure passes insensibly into the solid homogeneous rock.

This nodular formation is essentially different from any other as yet described. The nodular, or orbicular granite of Corsica, and the south of France, consists of alternating layers of different crystallized minerals,—the crystals all converging to the centre of each spheroid, and imbedded in a matrix different in substance and arrangement from the nodule: it would appear to owe its formation to chemical rather than mechanical forces, and its origin is probably analogous to that of the quartz nodules found at Bonmahon, County Waterford, or to the formation of agates, hollow spar, onyx, and other minerals of accretion.

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The *onion stone* of the Giant's Causeway, and some of the traps of Ayrshire, in Scotland, and of the south of Ireland, (together with the spherical trap of Shiant Island, mentioned by Dr. Maculloch,) consist of nodules, imbedded in a cement of a texture and composition totally different from their own; while each nodule, on being fractured, breaks into successive spherical shells, or coats, varying in hardness, and often in composition.

If speculation may be ventured upon the foregoing observations, it would seem to account for the phenomena to suppose, that the trap-dyke had been evolved beneath the sea at a temperature of fluidity; that in the violent agitation produced by the formation and ascent of steam, &c. portions of the fluid mass were projected upwards, became cooled in the water, and, falling again into the still imperfectly molten bed, were by its motions gradually re-enveloped, and again heated by contact nearly to its temperature. By these means (their texture being similar) an imperfect union would take place between the nodule and its matrix. When several of these nodules congregated, without intervening matter, they would cohere with flat surfaces, as before described; and when much more highly heated, (having fallen from a greater height, and so sinking deeper in the mass,) they would be again completely fused into the substance of the trap-rock, and thus present the case above alluded to of the gradual obliteration of nodular structure in some places.

It is even not an improbable conjecture, that the most capriciously variegated parts of this, and other similar traps and serpentines, may have been formed by the *soldering together* of nodules of diverse matter, either projected from different depths, or broken from the adjacent rocks forming the walls of the dyke; and it is possible that even the singular contortions in the stratification of mica-slate, &c. may have been produced by analogous means.

It is worthy of note, that these developments are entirely due to the *dissection* of the trap rock by the explosive force of gunpowder, but for which the discovery had never been made. This seems, then, to place in the hand of the geologist a new instrument for the prosecution of inquiries as to the intimate structure of unstratified rocks;—inquiries, which, should they reveal this nodular structure as more general than it is now known to be, will be likely to add much to our knowledge of the forces engaged in the production of rocks of igneous origin.

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V. *On a new Gaseous Compound of Carbon and Hydrogen. By* EDMUND DAVY, F.R.S. M.R.I.A., &c., *Professor of Chemistry to the Royal Dublin Society.*

Read 26th June, 1837.

I communicated to a Scientific Meeting of the Royal Dublin Society, and also to the last Meeting of the British Association for the Advancement of Science, held at Bristol in August, 1836, a brief notice of a new gaseous compound of carbon and hydrogen, I had previously obtained; in order to secure my claim to priority of discovery, and with the intention of subsequently submitting to the Royal Irish Academy a fuller and more detailed account of it. Circumstances, which it is unnecessary to mention, have hitherto prevented me from executing this design, which I shall now do myself the honor of carrying into effect.

In attempting to make potassium, on a large scale, in an iron bottle, by what has been called Brunner's method, i. e. by strongly heating a mixture of previously calcined cream of tartar, and about $\frac{1}{11}$ of dry charcoal powder, I failed; and instead of potassium, I obtained only a very limited quantity of a black substance, which choked up a part of the iron tube connected with the iron bottle. This black substance was hastily transferred to a dry bottle, which was then well corked. A small part of it was in powder, but the greater part in little lumps, which though apparently similar to the eye, yet produced different effects in water; for whilst some of those lumps slowly decomposed water, evolving only very minute globules of gas; others decomposed that fluid very rapidly, producing all the gas they would furnish, with nearly the same facility as potassium would have done, under similar circumstances. The gas, thus slowly produced, was on examination found to be hydrogen; whilst the gas rapidly evolved, possessed properties so different from any other known gas, as to entitle it to be

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regarded as a new combination. I purpose, at my earliest leisure, to make the black substance to which I have referred, the subject of a separate communication to the Academy, and to confine myself at present chiefly to the properties and composition of the new gas.

MODE OF OBTAINING THE NEW GAS.

The new gas was obtained by the action of pure water, (previously boiled for some time,) on the black substance. It was collected in a tube over water, by nearly filling the tube with dry mercury, putting into it a few lumps of the black substance, pressing the thumb closely to the top of the tube, so as to exclude any air, and inverting the tube in water; then by a slight relaxation of the thumb, the mercury was allowed gradually to descend, and the water coming in contact with the black substance, the gas was readily generated. In cases where the gas was collected over mercury, a few lumps of the black substance were placed at the bottom of a tube, which was held in an oblique position, and cautiously filled with mercury, so as to retain the black substance at or near the bottom of the tube, which, being then inverted in mercury, a little pure water was let up into the tube, when the gas was of course readily produced.

In every instance in which the new gas was collected, whether over water or mercury, some carbonaceous matter (apparently liberated during the generation of the gas) adhered to the sides of the tubes, and surface of the water or mercury; so that previous transfer to another receiver was necessary, before the gas could be used. Sometimes I operated on the new gas over water, at other times over mercury. In the subsequent experiments on its analysis, it was first collected over water in one tube, then transferred to another, which being filled with it, was removed to a mercurial apparatus, and dried first by means of bibulous paper, then let up into a dry receiver, and exposed for some days to the action of chloride of calcium, which had been previously heated to redness. Six grains of the black substance, I found, in one instance, yielded about two cubic inches of the new gas.

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PROPERTIES OF THE NEW GAS.

This gas is colourless, invisible, and possesses the mechanical properties of common air. It is highly inflammable, and when kindled in contact with air, it burns with a bright white flame, apparently denser, and of greater splendour, than that of olefiant gas, under similar circumstances. This may be strikingly shown by making a comparative experiment, and burning equal bulks of olefiant gas, and of the new gas, separately, in a tube;—the former will burn with a bluish flame, the latter with a bright white flame. If the supply of air is limited during the combustion of the new gas, there is a copious deposition of carbon in the form of light flakes. When the new gas was mixed with about six times its volume of air, it exploded, when kindled, producing a white flame and a whistling sound. One measure of the new gas being mixed with about ten measures of air in a tube, and kindled, produced a loud explosion, accompanied by a blue flame, which pervaded nearly the whole length of the tube. One measure of the new gas, and nineteen of air, burned rapidly with a blue flame.

The new gas forms with oxygen, a powerful explosive mixture, especially when the volume of the latter is about three or four times that of the former. In exploding a mixture of this kind in a detonating tube about half an inch in diameter, and nearly one-third of an inch thick, the tube was shattered in pieces by the violence of the shock, though the volume of new gas did not exceed $\frac{6}{100}$ of a cubic inch.

When chlorine is brought in contact with the new gas, instant explosion takes place, accompanied by a large red flame, the deposition of much carbon, and condensation (to a certain extent) of the two gases; and these effects occur in the dark, and are of course quite independent of the action of the sun's rays, or of light.

The new gas is permanent over mercury, and may apparently be kept over this fluid for an indefinite length of time, without undergoing any change. It is slowly absorbed by water, and agitation promotes the effect. I made the following experiment, to determine the quantity of the new gas which water would absorb:—

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Experiment.

Thermometer 55° Fah. Barom. 30°.

$\frac{5}{100}$ of a cubic inch of pure water (just deprived of air by air-pump) being added to $\frac{21}{100}$ of a cubic inch of the new gas, over mercury: after agitation for some time, the gas diminished to $\frac{16}{100}$, which, on examination, burned with a bright flame, and spontaneously exploded in chlorine. The aqueous solution of the gas, appeared to have no peculiar smell or taste, and did not affect litmus paper. On heating it over mercury, the gas was again expelled apparently unaltered.—Hence, I think I may venture to conclude, that pure water, recently deprived of air by the air-pump, will, at the above temperature and pressure, absorb about its own bulk of the gas, and that the gas may be again expelled, unaltered by heat.

The new gas is slowly absorbed by strong sulphuric acid, which, gradually acquires a yellowish or brownish colour, like that of a mixture of alcohol and sulphuric acid.

I have not ascertained the density of the new gas by experiment, never having had a quantity sufficient for that purpose at any one time; but from calculations founded on experiments made on its composition, which are given in the sequel; I estimate its density, (the barometer being at 30°, and thermometer at 60°,) as 0.917; atmospheric air being 1.000; and 100 cubic inches should weigh 28.4378 grains.

The new gas is gradually decomposed, when a series of electrical sparks, or discharges from a Leyden phial are passed through it; and there is a copious deposition of carbon, but no expansion, and scarcely any alteration of volume.

COMPOSITION OF THE NEW GAS.

Satisfactory evidences that the new gas is a compound of carbon and hydrogen, were gained, by firing a mixture of it with three or four times its volume of pure oxygen gas, over dry mercury; when the only products were carbonic acid gas and water. Also, by passing a series of electrical sparks, or discharges from a Leyden phial, through the new gas; when there was a copious deposition of

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carbon, and inflammable air* remained. I made many experiments to determine the exact composition of the new gas, using different methods; as firing it with oxygen or nitrous gas, or employing electricity alone; but the most satisfactory results I have obtained, were, by detonating a mixture of it with rather more than four, and five times its volume of pure oxygen, over dry mercury. This experiment, requires to be made with very limited quantities of the new gas, from the violence of the explosion. The necessity of operating on small portions of the gas, was a fortunate circumstance; as I have rarely had at my disposal, at any one time, more than a single cubic inch of it; and in general, a quantity scarcely exceeding the one-fifth of that volume. In one experiment, in which I fired a mixture of five measures† of the new gas, with twelve of oxygen, the residual gas burned with a pale blue flame, showing that the oxygen was not in sufficient quantity for the consumption of that gas. In a number of other experiments, I used the oxygen in larger proportion, but I did not obtain uniform results; owing, I conceive, to the impurity of the new gas, arising chiefly from admixture with a little hydrogen, occasionally liberated from minute portions of potassium, diffused through the black substance. In a few cases, the results agreed so exactly, that I shall venture to deduce the composition of the new gas, chiefly, from two experiments.

First Experiment.

4 measures of new gas, mixed with
17 „ of oxygen, diminished by electricity to
15 „ and by agitation in a solution of potash, to
7 „ which were oxygen.

Second Experiment.

3 measures of new gas, mixed with
16 „ of oxygen, diminished by electricity to
14½ „ and by agitation in limewater, to
8½ „ which were oxygen.

* Since this paper was read, I have ascertained, that the "inflammable air," here spoken of, is in fact, another new compound of carbon and hydrogen. A brief account of it was read at the last meeting of the "British Association for the Advancement of Science," held at Liverpool in 1837.

† The measures, here and subsequently noticed, were, each of them, equivalent to about seventy-three grains of mercury.

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Now, as in each of the preceding experiments, all the new gas disappeared, together with one-half of its volume of oxygen; and there was produced, a volume of carbonic acid gas, exactly double the bulk of the new gas employed; it seems obvious, that the diminution arose from the union of the hydrogen of the new gas, with half its volume of oxygen; and that its carbon required for consumption twice its volume of oxygen. I therefore conclude, that one volume of the new gas, requires for its complete combustion, two and a half volumes of oxygen; of which, half a volume unites with its hydrogen, to form water, and the remaining two volumes, with its carbon, forming carbonic acid gas. Hence, the new gas appears to consist of one volume of hydrogen, and two volumes of the vapour of carbon, condensed into one volume; and 100 cubic inches of it should weigh, 28.4378 grains, and contain,—

100 cubic inches of hydrogen, (ther. 60°, bar. 30°,)	2.1318 grains.
200 cubic inches of vapour of carbon, . .	26.3060
Weight of 100 cubic inches of new gas, . .	28.4378

The density of the new gas, should be 0.917 (estimating the weight of 100 cubic inches of atmospheric air, at 31.0117,) for 31.0117 : 28.4378 : : 1.000 : 0.917.

The above weights of hydrogen and carbon, are nearly in the ratio of

1 equivalent of hydrogen, ...	1
and 2 equivalents of carbon, ...	12.24
	13.24

So that the equivalent of the new gas is 13.24; the formula by which it is expressed is $2c + h$, or $c^2 + h$; and the name I shall venture to propose for it is *Bicarburet of Hydrogen*, which simply expresses its chemical constitution.

Additional evidence, that the carbon in one volume of *bicarburet of hydrogen*, requires two volumes of oxygen to convert it into carbonic acid gas, was obtained, by firing a mixture of four measures of it, with twenty-two measures of nitrous gas; when eight measures of carbonic acid gas were produced.

The effects of chlorine and also of electricity on the *bicarburet of hydrogen*, tend to confirm the fact, that it contains only its own volume of hydrogen. In the spontaneous mutual action of chlorine and *bicarburet of hydrogen*, these gases appear merely to condense each other in about equal volumes; forming

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muriatic acid gas, whilst the carbon of the *bicarburet* is liberated. Effects, which, as is well known, are analogous to the action of hydrogen and chlorine on each other, by electricity, or the solar rays. To notice a single experiment,—

Experiment.

$\frac{20}{100}$ cubic inch of chlorine, containing $\frac{1}{100}$ impurity, being let up into a graduated tube containing $\frac{7}{100}$ cubic inches of *bicarburet of hydrogen*, instant inflammation, and a copious deposition of carbon, took place; and $\frac{12}{100}$ cubic inches were condensed. Now $\frac{7}{100}$ of the gas $+ \frac{7}{100}$ of chlorine $= \frac{14}{100}$ muriatic acid gas; and it was found by experiment, that upwards of $\frac{6}{100}$ of chlorine must have been absorbed, in being let up through the column of water in the tube. These results agree as nearly as can be expected, in experiments of this sort.

Electricity occasions no expansion in the *bicarburet of hydrogen;* for after several hundred discharges of a Leyden phial were passed through it, and it was resolved into carbon and inflammable air, there was not the slightest increase of volume; on the contrary, there was a diminution of bulk, amounting to about one-tenth of the original gas, which I am inclined to refer to the admixture of a little common air.

From comparative experiments I made on the different hydrocarbonates, I am satisfied that the *bicarburet of hydrogen*, is more readily decomposed by electricity than olefiant gas, and this gas more easily than carburetted hydrogen.* Thus, after passing a thousand discharges from a moderate sized Leyden phial, through about one-tenth of a cubic inch of olefiant gas in a detonating tube, the gas was only partially decomposed; for there was merely a faint partial blush of black carbonaceous matter on the surface of the tube, nearest to the wires, and an expansion not exceeding one-half of the original volume. The same number of discharges being passed through an equal bulk of carburetted hydrogen, produced on the tube, only a small quantity of a dark brownish carbonaceous substance; and an expansion not exceeding one-third of the original bulk.—

* In the able work of the late Dr. Turner, "Elements of Chemistry," fifth edition, it is said, "light carburetted hydrogen is not decomposed by electricity;" but this statement is opposed to the experience of the late Sir H. Davy, and also to my own.

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—Whereas, after about one-fourth of the preceding number of discharges, were passed through an equal quantity of *bicarburet of hydrogen;* the tube was quite obscured by a blackish crust of carbon deposited on it, but there was only a very slight contraction of the original volume of the gas.

In another experiment, made in a tube, in which the wires were placed three times farther from each other, than in the tube used in the preceding experiments; and a very large Leyden phial was employed; the first strong discharge through the *bicarburet of hydrogen*, occasioned a considerable deposition of carbon, on the platina wires and tubes; and a half dozen similar discharges, greatly increased such deposition, but there was no change of volume in the gas. On similar discharges being passed, separately, through olefiant and carburetted hydrogen gases, no apparent effect, in either case, took place.

I made some experiments, with a view to ascertain whether I could make the bicarburet of hydrogen combine with an additional quantity of hydrogen.—Thus, I mixed those two gases in nearly equal volumes over dry mercury, there was no immediate effect, nor any change after they had been in contact about fifteen minutes. On letting up a globule of the mixed gases into a small glass of chlorine, a loud explosion took place, and carbon was deposited. Through a part of the above mixture, I passed about a dozen discharges from a small Leyden phial, but there was no apparent change; on letting up a globule of chlorine, inflammation instantly took place, and a second globule of chlorine produced a similar effect, with deposition of carbon in both instances. The mixture of the bicarburet of hydrogen and hydrogen, burned with a dense bright flame.

The *bicarburet of hydrogen*, appears to offer an exception to the principle established by the able researches of the late Dr. Henry, on the then known æriform compounds of charcoal and hydrogen; namely, "that the fitness of those gases for artificial illumination is greater, as they require for combustion a greater proportional volume of oxygen;"* for that gas, requires less oxygen for its combustion than olefiant gas, yet it illuminates much more powerfully than this gas. The superior illuminating power of the *bicarburet of hydrogen* is in strict conformity with the principle, that the degree of light emitted by the carburets of hydrogen, is dependent on the quantity of carbon they contain; the

* Phil. Trans. Royal Society, 1808 and 1821.

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bicarburet of hydrogen, therefore, ought to afford more light than olefiant gas, for it contains a greater relative proportion of carbon than this gas. The *bicarburet of hydrogen* contains $2c + h$; olefiant gas $2c + 2h$; hence, the effect of the additional proportion of hydrogen in olefiant gas, seems to be to diminish its illuminating power.

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VI. *Remarks on the Species of Seals (Phocidæ) inhabiting the Irish Seas.* By Robert Ball, Esq., M.R.I.A., &c.

Read 12th December, 1836.

It has been often said, that the history of the seal family is more obscure than that of almost any other group of the mammalia; and though much has been done by Fabricius, Nilsson, Thieneman, F. Cuvier, and others, still a great deal remains to be accomplished, before we can obtain a correct knowledge even of the species inhabiting our own shores.

Some years since I formed an opinion that I could distinguish four species of seals on the southern coasts of Ireland, but finding only two acknowledged as British, by zoologists, I became desirous of ascertaining which was the fact, and accordingly collected specimens from various parts of the coast. After having accumulated a number for this purpose, I endeavoured, in the first place, to ascertain of what species the seal of most frequent occurrence was; and with the kind assistance of Doctor Scouler, searched, but in vain, all the authorities to which access could be had in Dublin, while, at the same time, research was made by a distinguished naturalist, in London, with no better success. However, before deciding that the animal was altogether unknown to authors, I deemed it prudent to lay the matter before the British Association at Bristol, where Professor Nilsson was present. On inspection of crania he pronounced it to be his Halichœrus Griseus, (Phoca Gryphus of Fabricius,) and stated that it was described by him in his Scandinavian Fauna as the type of a new genus distinct from Phoca, and that it inhabited the North Sea and the Baltic. The characters on which his generic distinction is founded I could not ascertain from him, nor have I been able to get access to his work either here or in London. However the structure of the teeth in Halichœrus is alone quite sufficient to constitute a generic difference, the Molares*

* In some specimens the posterior molar has two or more roots, but this seems an accidental variety of form.

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being simple, approaching closely in form to those of some of the genus Delphinus, while in Phoca they have always more than one root. From conversation with Professor Nilsson, I learned that the Halichœrus of the Baltic is of solitary habits; in this it differs from ours, which is often seen in small herds. He attached great importance to colour as a character, so much that I am inclined to think it probable the species will ultimately be proved to be distinct, for the changes of colour from age, season, sex, &c. of our Halichœrus seem so various as to offer no guide to a determination of species. In the many specimens I have seen, I do not recollect that any two were precisely similar. The very young females are generally of a dull yellowish white, with rather long hair, which falls off in about six weeks after birth, and gives place to a shorter and more shining coat of a warm, dingy yellow, variously blotched with blackish gray; the whole gradually growing more dull, the blotching more indistinct, and a general dark shade spreading on the back as the animals advance in age. A young male in my possession has long yellowish hair slightly tinged with brownish black on the back; is black on the nose, chin, and cheeks, and on the palms of the fore-feet. The hair of the adult female Halichœrus, when dry, is considerably recurved, and is flattened on its upper surface, as if scraped with a knife. The optical effect of this structure is curious, for when the animal is turned with its head towards the spectator, it appears of a uniform silvery grey, and, when turned the other way, it seems of a sooty brown colour, while the spots or blotches are only distinctly visible from a side view. The hairs of the whiskers of all seals are remarkable in form; those of the Halichœrus are flattened in one direction, and contracted at regular intervals in the other, so that being viewed in front they appear linear, while, seen from the side they seem moniliform: they vary in colour in different individuals. The Halichœrus is easily distinguished from other seals by its straight profile, fierce aspect, and more lengthened proportions. The development of its skull is very much smaller than in the genus Phoca, the brain of one of the latter being as large as that of a Halichœrus of twice its length, and the intellectual powers seem to hold the same ratio. I recognized on sight, in the remains of Donovan's Phoca Barbata now in the British Museum, the skin of a Halichœrus much deformed by the mounter, and I find my observation has since been confirmed by Professor Nilsson. This seems to be the individual described by Parsons as the long-bodied seal, and it appears to have been on the authority

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of this specimen, that Phoca Barbata has occupied a place in the British Fauna. Sir Everard Home, in the Philosophical Transactions for 1822, gives a figure of a cranium, from a drawing of Mr. Hunter's, of a "skull of the great seal so many years deposited in the Museum, from the South Seas." Here, I suspect, some mistake has been made, and that the skull may have belonged to Donovan's seal, for I have a similar skull of one killed by myself, the skin of which was precisely like that just referred to. If Sir Everard Home's account be correct, the geographical distribution of the Halichœrus is indeed most strangely anomalous. I find the Palatal Foramina furnish an excellent character to distinguish the crania of the Halichœrus, (in the absence of teeth,) for they open in or on the palatal bones, while in all the skulls I have seen of Phoca they open in the maxillaries at more or less distance from their junction with these bones. Mr. Bell has just restored the original and appropriate specific name, and described our seal under the name of Halichœrus Gryphus accordingly.*

* W. Thompson, Esq., Vice-President of the Belfast Natural History Society, communicated to me in a letter the following interesting particulars, partly extracted from his journal, relative to the capture of a female Halichœrus with its young:

"*January* 31*st*, 1837.

"George Matthews, Esq., of Springvale, in the County of Down, informed me to-day that about three weeks ago, when setting out to shoot wildfowl near Ballywalter, accompanied by an attendant, they observed an old and young seal upon the rocks at such a distance from the sea as induced them to commence pursuit, in the hope of intercepting them on their return to it. In this they were so far successful as to capture the young one, which they fastened to the rock, hoping that its cries, which they compared to those of a calf, might attract the parent within gun-shot. They then concealed themselves to the windward of the old one, and for about an hour and a half saw it emerge at the distance of from four to five hundred yards, at least once every ten or fifteen minutes, but occasionally much more frequently. Seeing that it came no closer to the land, they changed their position to leeward, which they had no sooner done, than its nearer approach was apparent; and when from one hundred and fifty to two hundred yards from the shore, my friend fired at it with a musket charged with a single ball, which after passing through its head, was remarked to strike the water forcibly about forty yards further on. Life was not quite extinct when it was rowed up to. When brought ashore milk was extracted from its mammæ. This animal was of a uniform whitish grey colour, with darker spots; it weighed 3 cwt. and 18 lbs., but when in good condition would probably have been 4 cwt. On skinning it, two pellets were taken from near the hinder extremity, and a grain of large shot from the head; it had frequently been fired at before, and from superiority of size, had for many years been a well known character on the coast, and was distinguished by the name of *Old Skull*, in consequence of its favorite resort being a rock called Skull-Martin. The

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Learning some time since that seals were frequent on the Sligo coast, I requested Mr. T. Yeates of Drumcliff, in that county, to procure me specimens, and that gentleman soon after apprised me that a youthful brother of his had surprised a seal on shore, boldly seized it by the hinder extremities, and ultimately secured it. This individual unfortunately died before an opportunity occurred of transmitting it to me, and I received only the skull, which accords exactly with that of Phoca Vitulina, as described by F. Cuvier. Professor Nilsson, on its being produced to him, pronounced it to be identical with his Phoca Variegata. It agrees with the figure by Sir E. Home in the Philsophical Transactions for 1822, of the skull of a seal killed in the Orkneys, save that a few of the teeth in the upper jaw of the figure seem to belong to a different species from the others, and were probably supplied to make up for loss of the original. Mr. Bell, however, (possibly in consequence of these teeth,) has referred the plate to the species he calls Phoca Grœnlandica, but I rather apprehend that he is mistaken, for with the

young one was at least three feet in length, and was estimated to weigh about 60 lbs. It was of a canary colour on the back; the remainder paler, without spot or mark, except the muzzle, which was black; its hair was long and silky.

"Major Matthews states, that many years since he has seen from two to three hundred seals together on the rocks near Springvale, where they are now scarce, not from having been destroyed, but from the neighbourhood having become so much more populous, that the rocks they frequented are daily traversed by persons collecting the edible seaweeds, (Rhodomenia Palmata, Porphyra Vulgaris,) and limpets, (Patella Vulgaris.) They are still very numerous in the rocks a little farther southward, where, in the perhaps somewhat exaggerated language of the country, they are said to be seen 'in droves like sheep.' Major Matthews remarks, that when he has fired at seals looking towards him, they always dived from the flash of the gun, and that he was only successful in shooting them when their eyes were turned from him.

"From the description both of the young and adult animals above noticed, I had little doubt that they were your Halichœrus Griseus or Gryphus, and as their carcases still lay on the beach where they were skinned at Springvale, about twenty miles distant, I had them brought to Belfast, when by the aid of your lithographed drawings my supposition respecting their species was confirmed by actual inspection. I presented them to our Natural History Society, in whose Museum the skeletons of both are now in part preserved. Here is also a specimen of the Phoca Vitulina, which was shot December 28th, 1831, in the river Lagan, at some distance above the Long Bridge at Belfast; the tide, however, flows beyond the place where it was killed. Some years before a seal was obtained in the same locality, and in a deep pool beneath one of the arches of the bridge just mentioned. Our friend, Mr. G. C. Hyndman, on one occasion saw two young seals, most probably of the common species."

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exception alluded to, the figure would serve as a good portrait of the skull in my possession, and there is no sudden increase in the breadth of the intermaxillary bones where they join the nasal so conspicuous in the seal of the Severn hereafter noticed, to which he also applies the specific name of Grœnlandica, considering it identical with the Orkney seal.

On the 30th of September last, I received from my friend Mr. Yates a living specimen, taken two days before at Lissadill, County Sligo. It appeared in perfect health, was about three feet eight inches in length, and its short muzzle, high forehead, and large eyes, strongly distinguish it from Halichœrus. When wet, it is almost black, variegated with whitish slate colour, and is somewhat lighter on the breast than on the other parts: when dry, it is of a light, pearly grey colour. It had, when I received it, a portion of long fawn-coloured hair on its flanks, evidently the remains of a more general coat, but this fell off in a few days. On turning this seal out on the grass at the Zoological Gardens, it advanced fearlessly on the person nearest to it, and was not to be turned aside, though pretty smartly struck with a heavy cloth. Its mode of battle is, when within a proper distance, to turn on its side, and scratch with its uppermost fore-paw, which it is able to extend considerably, and use with great power and rapidity. It seldom attempts to bite; and I have not observed it snarl in the unpleasant manner uniformly practised by all the Halichœri I have seen in captivity. It has a singular and effective mode of progression, accomplished by convulsive starting jumps as it lies on its side, with its fore-paws on its breast, and its hind ones closely pressed together. Its ordinary motion, a sort of gallop, is tolerably rapid, and the power of continuing it is considerable, as was evidenced by its having passed over rough ground to a distance of at least a mile and a half, on escaping one night from the place in which it was confined. This animal refused food for twenty-two days after its original capture, but has since fed freely on whiting,* (Gadus Merlangus,) which is swallowed whole, the head merely being first a little bruised. It knows the keeper, and can distinguish at a distance whether he has fish with him or not. Its attention seems always alive to passing objects, and when a bird alights in its cage, the attempt to capture it is quite laughable: the seal commences by fixing its eyes on it with all the apparent earnestness of a pointer dog,

* It is allowed 6 lbs. of fish *per diem*, but would eat much more.

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then makes a plunge headforemost, and on the bird escaping, exhibits very evidently its disappointment.*

A specimen similar to that just described was killed with small shot in the river Liffey, not far from the Custom-house, by one of the Coast Guard Service, on the 23rd of October last. In its stomach were some half-digested fish, which appeared to be the sand launce, (Ammodytes Lancea.) I have been informed that seals are not unfrequent in this river, whither they are supposed to follow herrings.

I perceive Mr. Bell quotes Professor Nilsson as authority for a "character of unerring certainty" in this species, (Phoca Vitulina,) which consists in the obliquet direction of the molar teeth. I must however observe, that the obliquity of the teeth is consequent on the insufficient development of the jaws in early life; it is even observable in the very young Halichœrus, and disappears in Phoca Vitulina long before the skull attains its maximum size; it cannot therefore be held as a specific character. Mr. Bell has very properly retained the name of Vitulina, which was changed by Nilsson to Variegata, on the grounds that three species had been confounded under it, but that now described is certainly the one for which the appellation was originally designed.

Doctor Riley of Bristol exhibited at the Meeting of the British Association, the skeleton of a seal which was killed in the Severn, and had passed under the name of Phoca Vitulina. I perceived that it differed from any I had before seen, and Professor Nilsson being appealed to, pronounced it to be his Phoca Annellata. This species has been referred by Mr. Bell to the Phoca Grœnlandica, and Professor Nilsson, on further examination, concurred in this opinion. I am however compelled to express dissent, on the grounds that the teeth in the skull of the seal killed in the Severn are broader, and their tubercles more deeply divided from each other; that the lambdoid suture is less rudely crested, and the ridges running from the nasal, and almost bisecting the parietal bones, are less conspicuous than in the true Phoca Grœnlandica; and further, that the seal just alluded to is a tolerably large species, while that of the Severn is evidently a

* This animal died in March suddenly, after six months confinement; it was apparently thriving, and became daily more familiar.

† Since writing this I have seen the skeletons of several species of seal at the Jardin des Plantes at Paris, and the obliquity of the teeth was less conspicuous in Vitulina, than in many others.

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small one; that I never saw a seal in this country which I could suppose to be represented by the figure of Grœnlandica in Griffith's Cuvier, or Mr. Bell's British Quadrupeds; and that a seal which I saw distinctly through a telescope on the Welch coast, which I think it likely was of the Severn species, differed very much from that figure, being of a slight form, uniform colour, and rounded head. These observations show, I think, sufficiently that the seal in question is not the Grœnlandica, but the data are so scanty, that I am unable to offer an opinion as to what is the real species, which I believe is yet to be determined.

Since writing the foregoing, I have seen at Paris, through the kindness of M. De Blainville, the original skull of the Phoca Grœnlandica, sent by the French ambassador from Copenhagen; and M. Frederick Cuvier having favored me with an inspection of his unpublished plates, &c. on the Phocidæ, I feel now quite confirmed in the opinion before formed, that the seal of the Severn is not satisfactorily determined.

The following notices may serve to call attention to the investigation of species occurring on the southern and western coasts, which at present are not sufficiently known. I believe that a fourth species of seal exists on the southern coast, with a larger head and blunter muzzle than any of the three alluded to:—I have seen such a creature occasionally in storms, but never had opportunity of observing it closely. This may prove to be the Phoca Barbata, of which species there are some skulls in the Museum of the College of Surgeons here, but no account of where or when procured.

A seal-hunter, who has been borne out in several other wonder-creating stories, has told me, that he killed, a few years ago, on the coast of Waterford, a male seal, measuring nineteen feet in length; that it was, when he first saw it, in combat with one of an ordinary size. He was not able to give any other distinguishing character, save that it had much less hair than any other seal he had seen.*

* R. W. M'Ilwray, Esq., of the County Mayo, kindly favored me with the following account, in reply to an inquiry of mine as to a seal said to have been seen by him:

"Inniscarrow Reef, about eight miles from Westport, was a favorite haunt of seals; and on the day I saw the extraordinary species you allude to, there could not be less than 150 seals basking on it. I got my booker to windward of the Reef, which was the opposite side to where they lay, and dropped down gently with the punt without using an oar, lest I should alarm them, and landed, accompanied by one of my boatmen; in a few minutes we crept to within fifty yards of them, when

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It may assist the investigation of the history of the seals of our coasts to remark, that to observe them properly requires great patience and practice; they are exceedingly cautious, and retreat on the approach of man. The use of a telescope greatly facilitates operations, for by sweeping from a distance the rocky shores frequented by these animals, they may often be discovered where they would not otherwise be seen, and may be cautiously advanced upon. Seals dive out under boats entering their caves, and are probably thus seldom noticed except by persons acquainted with their habits; that they may be struck with a harpoon in so passing, I satisfactorily proved in August, 1829,* when, assisted by some friends, I succeeded in killing a very large Halichœrus at Howth. It was one of several that passed under us with great velocity, about eight feet deep in the water, each appearing like an enormous elongated globule of mercury as it shot under the boat. The animal killed possessed great strength, it was a female, and appeared to be suckling young at the time; though judging from its much

I singled out and shot the largest I could see, (which weighed afterwards twenty-six stone, and was nearly six feet long,) as he was quite dead when I got up to him, I ran on, after loading my rifle again, to the edge of the water, where the whole herd had plunged in, when I fired, knowing I was sure of a shot on their rising, which many of them invariably do within a few yards of where they dive. As there was a considerable descent to the water's edge I had nothing to rest my rifle on, which from its great weight and length, upwards of five feet, I am generally obliged to do; I made my boatman stoop, and rested it on his back, and almost immediately the extraordinary seal came to the surface, and I had ample time to observe him. The head was greatly larger than any I had ever seen, with immense bladder-like protuberances over the eyes, inclining to the sides of the head. The forehead appeared also uncommonly enlarged, and as I thought, deeply furrowed and wrinkled, lessening gradually to the protuberances at either side; it had external ears like a hound, but much smaller in proportion to the size of the head. The colour was light brown, but it did not appear to me to have spots like our common seal. I am quite certain it was much more than twice as large as any of our common kind. From the uncouth, and I might say very unnatural appearance of the animal, my poor boatman's superstitious fears so completely got the better of him, that he made a sudden start, and fell forward among the rocks on which we were, and in the fall my rifle went off, of course without effect, and I saw no more of the seal. I had my boatmen on the look out for several tides, both there and at several other of their haunts on the coast, but never heard of him since. I recollect seeing one of the same kind, or at least having the protuberances, near the Island of Anticosti, in the Gulf of St. Lawrence; and last year, on my return to Oban from Staffa, a gentleman told me he saw one a few days before in the Sound of Ulva that had external ears, and an unusually large head."

* For a more detailed account see Bell's British Quadrupeds, p. 282.

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worn teeth it must have been very aged. Its skeleton measures seven feet two inches in length.

Believing, with Cuvier, that the history of the seals can only be elucidated by a new series of observations, I have made few allusions to former writers on the subject, and conclude with a hope, that others who have more time and opportunity than I have had will continue the investigation here commenced, into the history of the Phocidæ of Ireland.

EXPLANATION OF PLATES.

HALICHŒRUS GRYPHUS.

Plate I.—*Fig.* 1. Female shot by Captain Sommerville Digby, July, 1836, at Lambay, near Dublin; supposed to be two years old; six feet in length.

Fig. 2. Young male, taken at Youghal, County Cork, October, 1832.

Fig. 3. Young female, killed with its mother near Youghal.

Plate II.—*Fig.* 4, 5, 6. Skull of No. 1.

Fig. 4, *a. a.* Palatal Foramina, alluded to at page 91, line 9, to compare with *a. a.* fig. 14.

Plate III.—*Fig.* 7. Lower jaw of No. 3, natural size.

Fig. 8. Do. No. 1, do.

Fig. 9. Do. mother of No. 3, do.

Fig. 10. Teeth of Do.

PHOCA VITULINA.

Plate IV.—*Fig.* 11, 12. Seal taken at Lissadill, County Sligo, Sept. 1836.

Fig. 13. Seal shot in River Liffey, October, 1836.

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Plate V.—*Fig.* 14, 15, 16. Skull of seal taken in Sligo, 1835.
Fig. 17. Teeth of ditto, natural size.

Plate VI.—*Fig.* 20, 21. Cæcum and great sinus of the hepatic veins of No. 13, to compare with 18 and 19, the cæcum and great sinus of the hepatic veins of No. 2. The animals were very nearly of the same size.

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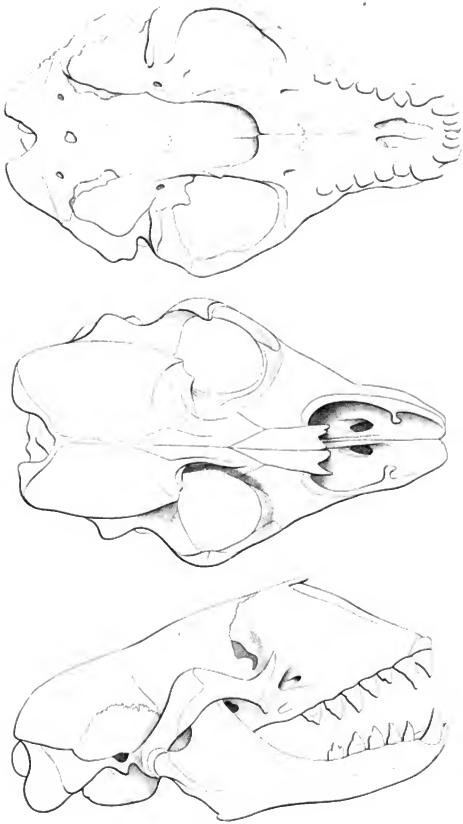

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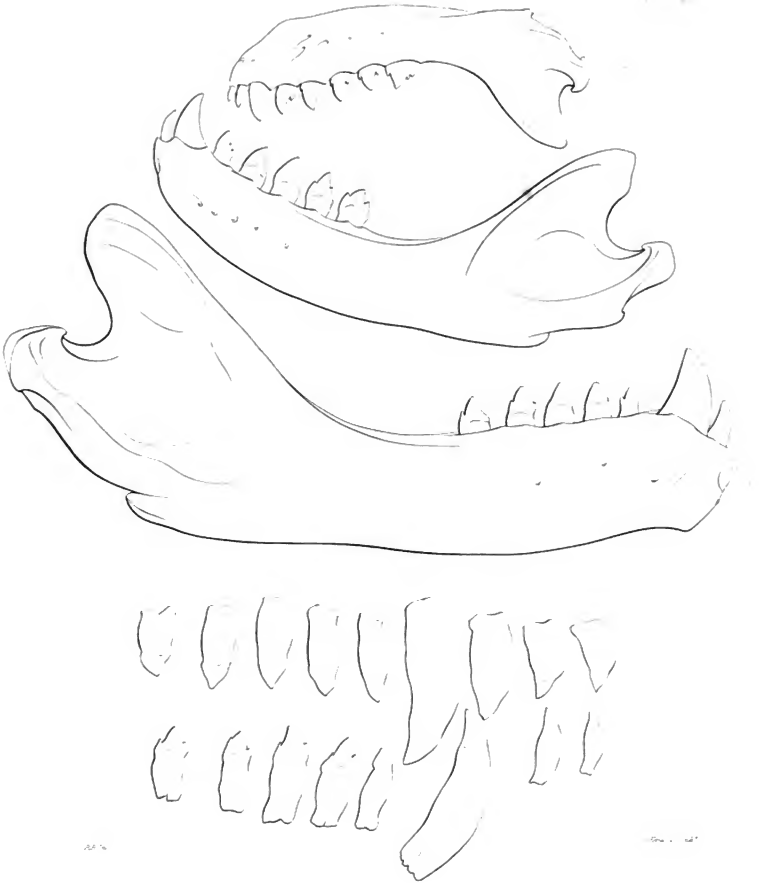

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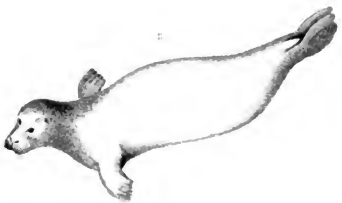

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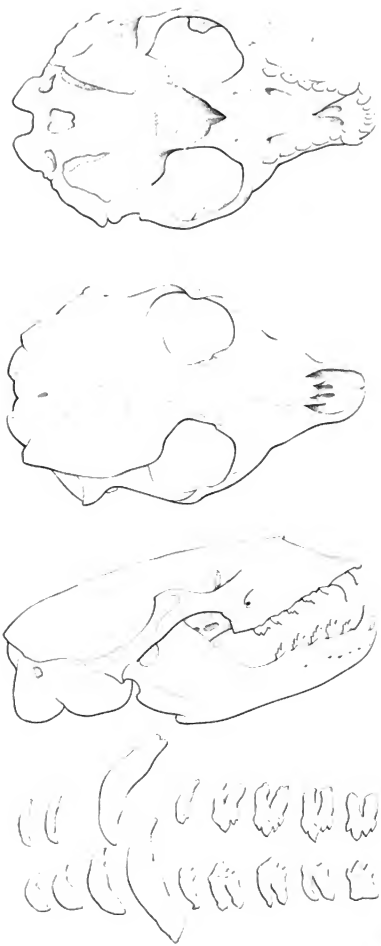

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VII. *On a Series of Combinations derived from Pyroacetic Spirit.* By ROBERT KANE, M.D., M.R.I.A., *Professor to the Royal Dublin Society and to the Apothecaries Hall of Ireland, Corresponding Member of the Society of Pharmacy and of the Society of Medical Chemistry of Paris, Honorary Member of the Society of Apothecaries of the North of Germany, &c.*

Read 16th March, and 10th April, 1837.

A great deal of labour has been bestowed upon pyroacetic spirit by successive chemists, with but imperfect results towards the development of its real nature. Notwithstanding the researches of Chenevix, Macaire, Mateucchi, and many others, the determination of its composition lately by Liebig and by Dumas, is the only numerical fact belonging to it of which chemists are in possession.

Pyroacetic spirit is known to be generated by heating to redness an acetate of a powerful base, the acetic acid being resolved into carbonic acid and this inflammable liquid; or likewise by passing the vapour of dilute acetic acid through a tube filled with coarse fragments of charcoal, and heated to dull redness. Its composition is found to be per cent.

Carbon = 62.5
Hydrogen = 10.2
Oxygen = 27.3

And its formulæ $C_2 H_3 O$.

The vapour of pyroacetic spirit is found to have a density of 2.022, and the results of the following experiments prove that the atom of pyroacetic spirit corresponds to four volumes of vapour. To represent the combining proportion of this body we must therefore take double the ordinary formula as given above, and consider $C_6 H_6 O_2$ as the constituents of its atom.

It may serve to give a clearer insight into the connexion of the following

substances, and to prevent reiteration in the description of them, if a general view of the results be now presented, and the names by which it is proposed to designate these bodies be detailed.

By the loss of successive portions of its oxygen and hydrogen in the form of water, there are obtained from pyroacetic spirit substances having the composition C_6H_5O and C_6H_4. By reactions, to be described hereafter, there are produced other bodies having the formulæ C_6H_5Cl and C_6H_5I. The body C_6H_5O unites with acids, as the sulphuric and phosphoric, and forms compounds possessing acid properties and forming well characterized salts, the exact composition of which will be hereafter given: in all these reactions it is evident that the pyroacetic spirit follows the same general law as the pyroxylic and the ordinary alcohol; and as there are two theoretical views of the nature of the ordinary ethers, so can two views of the nature of these new bodies be assumed. But whilst I admit the possibility of explaining, perhaps all known phenomena, by each hypothesis, yet as I consider that of common ether, being oxide of ethyl, as most consonant with the general bearing of science, I shall adopt in this paper the corresponding view for the combinations I am about to describe.

The names Acetone and Pyroacetic Spirit, having reference not to the nature, but to one only of the many sources from whence this body can be obtained, it is necessary to substitute for these a name which can be made the foundation of a series, and not indicate any connexion with another substance, which, if real, is at least but accidental. The name Mesit was applied by Reichenbach to a liquid which he met among the products of destructive distillation, and which he took to be pyroacetic spirit; and without at all judging whether that fluid was or was not such, I shall adopt that denomination, and propose for the pyroacetic spirit the name Mesitic Alcohol. We thus obtain

C_6H_4 mesitylene.

$C_6H_5O = C_6H_4 + HO$ mesitic ether; first hydrate of mesitylene.

$C_6H_5Cl = C_6H_4 + HCl$ hydrochlorate of mesitylene.

$C_6H_5I = C_6H_4 + HI$ hydriodate of mesitylene.

$C_6H_6O_2 = C_6H_4 + H_2O_2$ mesitic alcohol; second hydrate of mesitylene.

$C_6H_5O + SO_3$ sulphate of mesitic ether.

$C_6H_5O + 2SO_3$ bi-sulphate of mesitic ether.

$C_6H_5O + P_2O_5$ phosphate of mesitic ether.

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Or assuming a radical analogous to ethyl, we have, calling it Mesityl,

$C_6 H_5$ o oxide of mesityl.
$C_6 H_5$ *Cl* chloride of mesityl.
$C_6 H_5 O + SO_3$ sulphate of mesityl.
$C_6 H_5 O +$ HO hydrated oxide of mesityl; mesitic alcohol.

1. OF MESITYLENE.

When strong sulphuric acid is mixed with mesitic alcohol, there is immediately very great heat evolved, and the mixture becomes deep brown; if the quantity of acid be considerable, much sulphurous acid gas is evolved. The products of this reaction are complicated, and vary with the proportions of the materials; amongst them are, mesitylene, mesitic ether, and a peculiar solid waxy substance.

To prepare mesitylene, two volumes of pure mesitic alcohol are to be mixed with one of oil of vitriol, and the mixture distilled in a glass retort; by carefully managing the heat there is but very little frothing of the mass until the operation is nearly finished; there comes over a watery liquor, excessively impregnated with sulphurous acid gas, and a yellowish oil, which floats on the surface of it. This amounts in quantity to about one-fourth of the volume of the mesitic alcohol employed. It is to be decanted, and washed very well, to free it from sulphurous acid; then distilled, first in a water-bath, which frees it from a small quantity of the alcohol which had adhered to it, then, the water-bath being removed, the mesitylene distils over pure. The distillation must not be carried too far, as there remains in the retort a quantity of a substance, which, though less volatile, yet contaminates the last distilled portion of the mesitylene. The product is to be digested on well dried chloride of calcium for twenty-four hours, and then poured off, and again distilled. It may thus be obtained pure.

Mesitylene, when pure, is colourless, very light; it boils at about 276° Fahrenheit, and possesses a soft garlic odour, by which it is eminently characterized. It burns with a bright white flame, throwing off much smoke. It is not acted on by alkalies. With sulphuric and nitric acids, and with chlorine, it gives products which will be examined in another part of this memoir.

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To determine the composition of mesitylene, the following analyses were made:

I. 0.220 gramme material gave
0.206 water.
0.717 carbonic acid.

II. 0.329 material gave
0.315 water.
1.054 carbonic acid.

III. 0.248 material gave
0.236 water.
0.788 carbonic acid.

These analyses give

	I.	II.	III.
Carbon	= 90.14	88.59	90.08
Hydrogen	= 10.39	10.29	10.55
	100.53	98.88	100.63

The results of these analyses leave no doubt as to the real composition of the substance.

C_6	= 36.78 gives	90.19
H_4	= 4.00	9.81
	40.78	100.00

This body therefore is formed by the abstraction of two atoms of water from the mesitic alcohol, $C_6H_6O_2 - H_2O_2 = C_6H_4$. It occupies in the mesitic series the same position as the olefiant gas in the series of ordinary alcohol.

II. OF MESITIC ETHER.—OXIDE OF MESITYL.

In the reaction of sulphuric acid on the mesitic alcohol this substance is in the first instance produced, but on the heat being raised, the prevailing influence

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of the sulphuric acid destroys it, taking all the oxygen as water, and reducing the remaining elements to the state of mesitylene. If equal volumes of sulphuric acid and mesitic alcohol be mixed, and the vessel containing them plunged into cold water, to prevent as much as possible the consequent rise of temperature and evolution of sulphurous acid; and, when the deep-brown mixture has become quite cold, it be mixed with twice its volume of water, and allowed to stand for some time; there gradually separates to the surface a thickish fluid, which can be removed by the pipette, and purified by distillation with some lime.

This mass can be separated by rectification into a number of portions of different degrees of volatility. It is mostly mesitylene; it contains likewise a quantity of the solid matter before alluded to, and a quantity of a fluid more volatile than mesitylene, which is mesitic ether. It can be separated by this process only in small quantity, and with difficulty obtained pure; the best way of procuring it is that now to be described.

In the next section will be detailed a process for obtaining an impure chloride of mesityl easily in moderate quantities. This is to be dissolved in alcohol, and to the solution an alcoholic solution of potash added, until the whole becomes strongly alkaline, the liquor being warmed during the operation. There is now to be added six or eight volumes of water; there immediately separates a large quantity of an oily matter coloured yellow, and the liquor contains chloride of potassium. This oil is to be poured on chloride of calcium to dry it; then rectified, to free it from mesitic alcohol which comes over first, and a trace of mesitylene, which is the least volatile of all. This reaction is easily understood: the chlorine passes from the mesityl to the potassium, and the oxygen of the potash takes its place.

Mesitic ether thus obtained, and rendered pure, is limpid, very fluid, and colourless, of an aromatic odour, which may be compared to that of oil of peppermint; it burns with a very luminous, but somewhat smoky flame; it boils at about 248° F. Its combinations with acids will be hereafter described. Its composition was determined by the following analyses:

I. 0.610 gramme material gave
0.582 water.
1.628 carbonic acid.

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II. 0.433 material gave

0.410 water.

1.139 carbonic acid.

Giving

	I.	II.
Carbon	= 73.60	72.72
Hydrogen	= 10.59	10.52
Oxygen	= 15.81	16.76
	100.00	100.00

But C_6H_3O gives

C_6	= 36.78	73.88
H_3	= 5.00	10.05
O	= 8.00	16.07
	49.78	100.00

which is evidently its composition.

III. CHLORIDE OF MESITYL.

The preparation of this body in a state of purity proper for analysis is extremely difficult. If liquid muriatic acid and mesitic alcohol be mixed, the mixture assumes a dark colour; but on distillation, the mesitic alcohol is separated almost completely unchanged. If a stream of muriatic acid gas be passed into mesitic alcohol, it is absorbed rapidly and in large quantity, the solution becomes dark-brown, intensely acid and dense. The stream of gas must be continued for several days uninterruptedly, in order to produce the decomposition of two ounces volume of mesitic alcohol. When the dark heavy liquor thus obtained is washed with water, in which it sinks to the bottom, a large quantity of free muriatic acid is given off, and the fluid thus obtained, having been digested on some litharge, and then on fused chloride of calcium, is an impure chloride of mesityl. It sinks rapidly in water; is always dark-coloured; if freshly made it does not affect litmus paper, but being preserved for a night is sufficient to render it so

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acid as to emit copious muriatic fumes; at the same time it gradually becomes very dark-brown and opaque, and when heated effervesces, owing to the escape of muriatic acid gas. If distilled, a large quantity of muriatic acid gas is set free, and the distilled liquor always floats on water, owing to the quantity of mesitylene and some mesitic ether which it contains. It is consequently impossible to purify this body by rectification.

The substance thus obtained was very often submitted to analysis, but in no case was a satisfactory result obtained. The per cent. composition of a few of the specimens examined is subjoined, in order that the nature of the reaction by which it is generated may be more easily perceived. The determination of the quantity of the chlorine was made in the usual way by passing the vapour of the body over red hot lime.

	I.	II.	III.	
Carbon	= 55.9	64.5	59.9	
Hydrogen	= 8.5	9.3	8.6	100.
Oxygen	= 10.2	12.1	10.5	
Chlorine	= 25.4	14.1	21.0	

On calculating these results, it will at once be seen that the liquids analyzed were mixtures of chloride of mesityl with oxide of mesityl and mesitic alcohol; it is on this account that I made use of this impure substance to prepare the mesitic ether by the action of potash.

By the reaction of perchloride of phosphorus on mesitic alcohol a pure chloride of mesityl can be produced; for this purpose, perchloride of phosphorus is to be added to mesitic alcohol, with which, if not absolutely anhydrous, a lively reaction ensues; water is to be added in successive drops, and the effervescence moderated by placing the vessel in cold water; when a quantity of chloride of phosphorus, about double the weight of the alcohol employed, has been used, three or four volumes of water are to be added; there separates a heavy, slightly-coloured fluid, which is to be washed with the least possible quantity of water, and then poured on some recently fused fragments of chloride of calcium. As it does not dissolve any chloride of calcium, it can be analyzed without distillation, by which process it is in fact in great part destroyed, being resolved

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into muriatic acid gas and mesitylene. Notwithstanding the care that may be taken in this process, it is difficult to get a product free from mesitic alcohol or ether. In only one analysis did I obtain a result conformable to theory, and consequently that one only need be subjoined.

A. 0.483 gramme material gave

0.294 water.
0.826 carbonic acid.

From whence results

Carbon = 47.27
Hydrogen = 6.67

B. 0.673 material gave 1.252 gramme chloride of silver, corresponding to 45.88 chlorine per cent.

The formula $c_6 H_5 cl$ gives

$c_6 = 36.78$	47.66
$H_5 = 5.0$	6.49
$cl = 35.42$	45.85
77.20	100.00

It is thus evident that the body analyzed in this instance was chloride of mesityl almost absolutely pure.

IV. IODIDE OF MESITYL.

When iodine, phosphorus, and mesitic alcohol are treated precisely as in the manner for making hydriodic ether by common alcohol, the reaction takes place in the retort without any separation of carbon. Immense quantities of hydriodic acid gas are disengaged, and the liquid which distils over is very heavy, deeply coloured by iodine, and possesses an odour almost exactly similar to that of hydriodic ether. What remains in the retort is slightly tinged yellow, owing to its being mixed with a small quantity of a yellow substance, which is deposited in spangles, like iodide of lead. The liquid remaining in the retort solidifies, on cooling, into a mass of fibrous silky crystals. The distilled liquor, washed with water to remove adhering hydriodic acid, is still coloured by iodine, from which

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it may be freed by a little water of potash. It very soon again becomes coloured, iodine at first, and then carbon separating, and hydriodic acid gas being given off. This change takes place equally quick, whether the iodide of mesityl be in contact with water or not. In all cases the product is exceedingly impure. I have analyzed very many specimens prepared at different times, and never twice got the same result; there are always present quantities of mesitic alcohol, mesitic ether, and sometimes mesitylene; and as the iodide of mesityl cannot be distilled without undergoing a partial decomposition into mesitylene and hydriodic acid, it has been impossible to effect the purification of the distilled product.

By following a different method of preparation, I have from time to time obtained specimens of this substance, which gave me results approaching closer to the theoretic numbers, than those given by the fluid obtained by distillation. A small quantity of iodine is to be placed in a tube, and about twice its volume of mesitic alcohol to be poured on it; a piece of phosphorus is to be then dropped in; the reaction is to be supported for some time by the application of heat, and then water is to be poured into the tube, and the whole shaken together; a quantity of iodide of mesityl immediately separates, which is purer than any prepared by the process in which the materials are distilled.

The composition given by theory for the iodide of mesityl is,

C_6 =	36.8	21.9
H_5 =	5.0	2.9
I =	126.3	75.2
	168.1	100.0

When chloride of mesityl is distilled with a solution of sulph-hydrate of potassium in alcohol, there is obtained a yellowish fluid, lighter than water, and containing still a large quantity of unaltered chloride, with some mesitic ether; but as it possesses a strong disagreeable smell, and gradually deposits sulphur when kept, I think it very likely that a sulphuret of mesityl can be thus formed. The small quantity I had obtained did not allow me to set about the necessary means of purification.

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V. COMBINATIONS OF MESITIC ETHER WITH THE OXYGEN ACIDS.

When mesitic alcohol is mixed with twice its weight of strong oil of vitriol, the mass becomes very hot, dark-brown, and much sulphurous acid gas is formed. When the whole has cooled, it must be diluted with two or three volumes of water, and neutralized by a base; and when the carbonates of baryta, lime, or lead are thus employed, there are formed soluble salts, which have been examined. If the quantity of sulphuric acid employed had been smaller, similar salts are produced; but the substance found combined with the inorganic base is not the bi-sulphate, but the neutral sulphate of mesityl. It appears even that the salts of the proto-sulphate are those most easily formed, as I have sometimes obtained them when I had employed a large quantity of oil of vitriol in order to form bi-sulphate. The sulphate I shall call Sulpho-mesitylic Acid; and the bi-sulphate, Persulpho-mesitylic Acid.

VI. PERSULPHO-MESITYLATE OF LIME.

This salt forms, when evaporated, a deliqueseent granular mass, amongst which small prisms are interspersed. It can be completely dried without blackening, and thus loses one atom of water of crystallization. When heated strongly it takes fire, blackens, and leaves after ignition a white residue reacting very feebly alkaline. There is no acid whatsoever set free during the decomposition.

A. 0.529 of salt was heated with some nitric acid in a platinum crucible; the decomposition went on very quietly, and there remained a perfectly white residue of sulphate of lime, weighing 0.373, or 70.50 per cent.

B. 0.972 material gave

0.292 water,
0.651 carbonic acid;

or, per cent.

Hydrogen = 3.33
Carbon = 18.52

The formula $2\,so_3 + c_6h_5o + 2cao + ho$ gives

$2SO_3 = 80.32$	40.95	}	70.02 sulphate of lime.
$2CaO = 57.04$	29.07	}	
$C_6 = 36.80$	18.76		
$H_6 = 6.00$	3.06		
$O_2 = 16.02$	8.16		
196.18	100.00		

This is evidently the true formula.

Persulpho-mesitylate of baryta crystallizes in small pearly plates; when heated it becomes brown, chars, and sulphate of baryta remains; quite neutral.

0.430 salt gave 0.337 of sulphate of baryta, or 78.4 per cent.

The formula $2SO_3 + C_6H_5O + 2BaO + HO$ gives

$2SO_3$	= 80.3	27.5	} 80.0
$2BaO$	= 153.4	52.5	}
Oxide of mesityl	= 49.8	16.7	} 20.0
Water	= 9.0	3.3	}
	292.5	100.0	

It was not further analyzed.

The sulpho-mesitylate of lead appeared to be very deliquescent and uncrystallizable; it was not analyzed.

VII. SULPHO-MESITYLATE OF LIME.

This salt is generally formed when the quantity of oil of vitriol, added to the mesitic alcohol, is smaller than to produce the former class of salts; as, when two volumes of the alcohol are mixed with one of vitriol. The solution, when very much concentrated, forms, by cooling, a mass of small crystals not differing much in appearance from the persulpho-mesitylate,—from which, however, the result of analysis at once separates it.

A. 0.625 of this salt in crystals was heated cautiously in a platinum crucible, until all emission of watery vapour had ceased; the salt remained quite white. The residual mass weighed 0.580, or had given 7.2 per cent. of water. These 0.580 were dissolved in water, and decomposed by oxalate of ammonia. The

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oxalate of lime, collected and burned with the filter, gave 0.244 of carbonate of lime, containing 0.1374 of lime, or 23.7 per cent.

When this salt is warmed with nitric acid, the decomposition is always accompanied with a slight puffing explosion, owing to a very rapid sort of combustion pervading the whole mass. Consequently a quantity of the light residual sulphate of lime is always thrown out of the crucible. The residue is, however, quite neutral, and no free sulphuric acid is given off. In two experiments of this kind the quantities of residual sulphate of lime, although a portion had been lost, were 47 and 53 per cent.

B. 0.765 of the dried salt gave

0.304 water, and
0.848 carbonic acid,

corresponding to

Hydrogen = 4.40
Carbon = 30.29 per cent.

The formula $so_3 + c_6H_5O + cao$ gives

so_3	= 40.16	33.8
cao	= 28.52	24.1
c_6	= 36.80	31.0
H_5	= 5.00	4.2
O	= 8.00	6.9
	118.48	100.0

The 7.2 of water of crystallization, obtained above, corresponds to one atom; the formula of the crystals therefore is

$$so_3 + c_6H_5O + cao + HO.$$

A circumstance in which the salts above described differ from the analogics of the sulpho-vinates, sulpho-mesitylates, and sulpho-napthalates, is that the quantity of the inorganic base is sufficient to neutralize the whole of the sulphuric acid. It is on this account that I have given to the acid first described the name of Persulpho-mesitylic; as the word Bisulpho-mesitylic might imply that the quantity of acid was double that necessary to neutralize the inorganic base present in the salt.

On decomposing the baryta salts of the sulphate or of the bi-sulphate of

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mesityl, by means of sulphuric acid, some liquors were obtained, which, when heated, began to smell strongly of mesitic ether, and contained free sulphuric acid; evaporated still more, the solutions became black, and sulphurous acid was exhaled. It thus appears that both sulphates are soluble in water, but I was not able to effect their perfect isolation.

It will be at once seen that the salts of the persulpho-mesitylic acid may be represented as double salts, consisting of the sulpho-mesitylate united to sulphate of the same base. Thus

$$2SO_3 + C_6H_5O + 2CaO + HO$$

is evidently equal to

$$(SO_3 + C_6H_5O + CaO + HO) + CaO.SO_3.$$

I will not at present enter into any details connected with this view, which will be at once seen to bear upon the cause of the sulphuric acid retaining its full power of neutralization.

VIII. OF THE HYPO-PHOSPHO-MESITYLOUS ACID.

Of this acid, the existence of which is at present quite without analogy in organic chemistry, only the baryta salt has been examined; the properties and composition of it are, however, so characteristic, as to leave no doubt of its real nature.

When iodide of mesityl is prepared by distilling a mixture of iodine, phosphorus, and mesitic alcohol, there remains in the retort (provided there be some phosphorus in excess) a thick fluid, which, on cooling, solidifies into a mass of crystals resembling amianthus. The decomposition goes on without any separation of carbon; the only products are the iodide of mesityl (impure), the white fibrous crystals, and a very small quantity of a yellow matter, which will be noticed hereafter. These crystals are soluble in water, forming a colourless liquor, with a taste at once strongly acid and intensely bitter. The liquor, neutralized by carbonate of baryta, gives a white insoluble salt, and likewise a soluble one. The solution is to be evaporated nearly to dryness, and then allowed to cool, when it forms a crystalline mass. This mass is then to be boiled in strong alcohol, which dissolves out a quantity of iodide of barium, arising from hydriodic acid with which

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the crystals had been contaminated in the retort. The boiling in alcohol must be repeated until the residual salt no longer gives any trace of iodine when moistened with nitric acid. It may then be considered pure; as, though prepared at different periods, it has always given the same analytical results. The salt appears as a mass of small white crystalline grains, of an amylaceous appearance, neutral to test paper. When heated it takes fire, burning with a pure phosphorous flame, and throwing off copious fumes of phosphoric acid; when the phosphorus ceases to be emitted the residue is black, but further heated it gives a pure white residue of phosphate of baryta. When moistened with nitric acid, and heated, a very violent reaction ensues, and unless great caution be employed, some of the materials are projected out of the vessel: in any case some phosphorus is lost, being disengaged in the gaseous form. When this salt has been once obtained solid, there is great difficulty in dissolving it completely in water again, although no marked difference of composition can be observed between the portion which dissolves and that which remains unacted on.

0.700 of the salt was moistened with nitric acid, and very cautiously decomposed by heat in a platinum crucible. The action was violent, but without any projection of the solid materials. The residue was treated with nitric acid until it remained white; it weighed 0.520, giving 74.3 per cent. It was dissolved in dilute nitric acid, and the solution precipitated by sulphate of soda. There was obtained 0.467 of sulphate of baryta, corresponding to 43.8 of baryta, from 100 of the salt employed.

0.368 of salt similarly treated gave 0.277 residue; which, dissolved and treated as above, gave 0.247 sulphate of baryta, or 67.1 per cent., containing 44.0 of baryta.

I. 0.469 material gave
0.169 water,
0.346 carbonic acid;

corresponding to

Hydrogen = 4.00
Carbon = 20.40 per cent.

II. 0.566 material gave
0.186 water,
0.399 carbonic acid;

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corresponding to

Hydrogen = 3.65
Carbon = 19.49

There are two formulæ by which the properties of this salt can be explained, and with which the analytical results harmonize. One of these assumes the phosphorus to exist half as phosphoric acid and half as phosphuretted hydrogen, the salt containing no water. In the other the phosphorus is represented as being all as hypo-phosphorous acid, while the salt contains an atom of water chemically united, and which cannot be expelled by any temperature not producing complete decomposition. Thus,

$P_2O_3 + 2BaO + 2(C_6H_5O) + P_2H_3$ gives

$2P_2$	= 63.0	17.6
$2BaO$	= 153.4	42.7
C_{12}	= 73.6	20.5
H_{13}	= 13.0	3.6
O_7	= 56.0	15.6
	359.0	100.0

and $P_2O + BaO + C_6H_5O + HO$ gives

P_2	= 31.5	18.0
BaO	= 76.7	43.8
C_6	= 36.8	21.0
H_6	= 6.0	3.5
O_3	= 24.0	13.7
	175.0	100.0

Of these two formulæ, I consider the latter to be much the more probable. We have, even in the inorganic kingdom, but very few examples of phosphuretted hydrogen replacing water, either when the latter is basic or as water of crystallization; and the relation which the oxygen of the two oxides bears to that of the phosphoric acid is not any of those usually met with in the phosphates. On the contrary, the latter formula gives the composition of a basic hypophosphite, which the addition of four atoms of oxygen would change into an ordinary phosphate;

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the ratio of the oxygen in the united bases being to that of the acid as three to five.

IX. OF THE PHOSPHO-MESITYLIC ACID.

When glacial phosphoric acid is mixed with its own weight of mesitic alcohol, considerable heat is evolved, and the mixture becomes dark-brown. On neutralizing this liquor with a base, a soluble phospho-mesitylate is obtained, but in very small quantity. The phospho-mesitylate of soda crystallizes in fine rhomboidal plates; exposed to the air the crystals become opaque, owing to the loss of a certain quantity of water by efflorescence. When heated, they melt in their water of crystallization, leaving a white mass; and this, when heated more strongly, froths up, blackens, and finally burns, leaving a white residue of phosphate of soda.

The small quantity of this salt which I had obtained prevented me from analyzing it further than by determining the quantity of water and of phosphate of soda which it contained.

0.379 of the crystallized salt, when warmed cautiously until it ceased to give off watery vapour, but remained quite white, weighed 0.295; and having been then ignited, gave 0.185 phosphate of soda, corresponding to

Water	= 22.2	100.00.
Phosphate of soda	= 48.8	
Organic matter	= 29.0	

The formula $P_2O_5 + C_6H_8O_2 + NaO + 5HO$ gives

Phosphate of soda	= 49.7	100.00.
Mesitic alcohol	= 28.4	
Water	= 21.9	

As an atom of water remained behind with the mesitic ether, it may be considered that the phosphoric acid has three atoms of base and five of water of crystallization. The formula is

$$P_2O_5 + \{NaO + C_6H_7O + HO\} + 5HO.$$

A more detailed examination of these different classes of salts would be a very useful subject for the attention of other chemists.

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On the discovery of the compounds which are now about to be described, I was for a time under the impression that I should find, as a product of some of their reactions, the ulmic acid, and consequently I proposed to distinguish the carbo-hydrogen, of which they may be considered to be composed, by the name Pteleyl, from *πτελεη, ulmus;* this radical being also contained in ulmic acid, the formula of which is $5\,(C_6H_3O_2)$. Now although this acid is not actually formed as a member of the series under examination, yet I am induced to retain the word Pteleyl, as indicating a degree of alliance with it which there is good reason to admit. Provided the name be well understood, the sound does not much signify; and I could not well find a better.

It will be seen that most of the following bodies relate to mesitylene, which indeed bears in this series the place of olefiant gas in that of vinic alcohol; and as the latter may, and indeed should be looked upon as a combination of hydrogen with the radical of acetic acid,—that is, as a hydruret of acetyl,—so may we consider, for the illustration of the following results, the mesitylene as a hydruret of pteleyl,—that is, we make the formula $C_6H_4 = C_6H_3 + H$.

X. OF THE CHLORIDE OF PTELEYL.

When a current of dry chlorine gas is conducted into pure mesitylene, it is abundantly absorbed with the evolution of much heat and a strong effervescence, owing to the escape of a large quantity of muriatic acid gas. Continuing the supply of chlorine, small needles begin to form at the edge of the fluid, and finally, the whole quantity solidifies into a mass of acicular crystals. These must be dissolved in boiling ether, from which they are deposited in brilliant white four-sided prisms by cooling, whilst the excess of mesitylene remains dissolved; they require to be many times redissolved and recrystallized before they can be considered pure, and must be dried finally by pressure between folds of blotting paper,—not by exposure to the air. These crystals resemble very much those of the commercial di-sulphate of quinine. They are insoluble in water; are not acted on by a solution of potash in alcohol or in water; are volatile without decomposition, but require a high temperature, and can be sublimed in an atmosphere of

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dry ammonia without alteration. Their composition was determined by the following analyses:

A. 0.352 of the crystals gave

0.145 water,
0.645 carbonic acid;

corresponding to

Carbon = 50.66
Hydrogen = 4.00 per cent.

The difference is necessarily chlorine.

These crystals, added to a new quantity, were recrystallized from ether, and then again analyzed.

B. 0.549 material gave

0.215 water,
0.976 carbonic acid;

corresponding to

Carbon = 49.15
Hydrogen = 4.34 } 100.

The body consisting of $c_6 H_3 cl$ gives

Carbon = 48.87
Hydrogen = 3.99 } 100,
Chlorine = 47.14

with which the analyses agree.

The solid substance is thus formed from mesitylene, an atom of hydrogen being replaced by one of chlorine; the hypothetic radical $c_6 H_3$ remaining constant.

XI. OF IODIDE OF PTELEYL.

I have given this name to a substance, of which I have never been able to obtain a quantity sufficient for analysis; but from the circumstances under which it is formed, and the properties I have found it to possess, I believe such to be its nature.

Mesitylene dissolves iodine in large quantity, forming a deep-red solution;

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but although exposed to the solar light for several weeks, there is no appearance of alteration. This solution may even be distilled without any change being produced. This mode of reaction, therefore, affords no results.

It has been already mentioned that when iodine, phosphorus, and mesitic alcohol are distilled together, in order to form iodide of mesityl, there is evolved a large quantity of hydriodic acid gas, and much free iodine distils over with the impure iodide of mesityl. In the retort there remains a liquor, which, on cooling, deposits the fibrous crystals of hypophospho-mesitylous acid, with which are mingled small gold-coloured scales, resembling in appearance crystallized iodide of lead. On dissolving the hypophospho-mesitylous acid in water these remain undissolved, and can be separated by the filter; when dried, they lose their brilliant appearance, and form a golden-yellow powder. This powder is insoluble in water, but dissolves in ether, from which it is deposited in brilliant spangles, which again become dull on exposure to the air. It is volatile, but requires a temperature nearly approaching to redness for its volatilization. When cautiously heated, it sublimes without alteration, and forms a brilliant gold-coloured sublimate; but if the vapour be passed through a portion of the tube, previously made very hot, carbon is deposited there, and a large quantity of iodine set free. I attempted to generate this substance by heating together chloride of pteleyl and iodide of lead, but the great part of the chloride sublimed unaltered; and though there were very evident indications of its being produced in minute quantity, the process cannot be employed with advantage.

This substance evidently possesses considerable analogy with iodoforme, (ter-iodide of formyl), which it resembles closely it its appearance, colour, and relation to alcohol, water, and ether. It is, however, completely distinguished from it by its permanence in regard to heat. Dumas states, and I have verified the observation, "A une temperature peu elevée, insuffisante pour charbonner le papier, il se decompose en iode, l'acide hydriodique, et charbon." It is interesting to recollect too, that the formyl is a radical polymeric with pteleyl; the former being C_2H, the latter C_6H_3.

The circumstance of its being formed by the action of iodine on nascent mesitylene, and the great analogy between its properties and those of the chloride of pteleyl, induce me to consider it as the iodide of that radical, and its formula C_6H_3I, giving for its composition

Carbon	= 22.17	
Hydrogen	= 1.75	100.00.
Iodine	= 76.08	

XII. OF HYPO-NITRITE OF OXIDE OF PTELEYL.

When mesitic alcohol is treated with sulphuric acid and peroxide of manganese, it distils over perfectly unaltered if the acid be employed dilute;—and if strong acid be employed, the products are merely mesitylene and traces of mesitic ether;—the manganese being left out of the reaction, and the acid and alcohol acting, as described in the former part of these researches.

If pure mesitic alcohol be mixed with one-half its own volume of strong nitric acid, and the mixture warmed, a very violent effervescence takes place, and a great quantity of red fumes is given off; if the application of the heat be continued for the purpose of distilling the mixture, the decomposition becomes explosively violent, so that on two occasions where it was attempted, the retort was burst. When with the idea of moderating the action a dilute acid is employed, but little change takes place, and the product in the receiver consists of mesitic alcohol quite undecomposed. If, however, on mixing the strong nitric acid and mesitic alcohol, and warming the mixture until the effervescence shall have commenced, the vessel be plunged into cold water, and the action thus retarded,—then again a little warmed, and again cooled, this treatment being repeated several times,—and finally, the whole mixed with five or six volumes of water, there subsides a heavy, pale yellow, fluid, which may be washed with water, until all adhering acid be removed, and then dried by digestion on some fragments of pure chloride of calcium. Thus obtained, this fluid is a mixture of two, and its consistence varies according as the one or the other preponderates, the one being thin, the other about semifluid. The quantity of the latter is greater, according as more red fumes have been driven off; the former predominates when the dilution with water was effected before the decomposition had proceeded far. Neither can be thus obtained absolutely pure, but their nature may be determined with sufficient certainty.

The lighter and thin fluid substance is heavier than water, by which it is gradually decomposed. It is immediately dissolved by an alkali, the liquor becoming

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dark-brown; and paper dipped in it burning, when dried, with the characters of touch-paper. Its odour and taste are penetrating, but sweetish. When heated in a water-bath, it shows no appearance of vaporization; and if exposed to the flame of a lamp, it is decomposed with an explosion so violent, if a moderately large quantity be employed, as to shatter the apparatus. The products are red fumes of hyponitrous acid, mixed with a very heavy white smoke, and the bottom of the retort is lined with a copious deposit of carbon. These properties completely prevent the purification of the substance by distillation, and render its analysis at once difficult and uncertain in its results. Several experiments were, however, made to determine its composition, which, from the coexistence of the thicker fluid, never gave twice the same absolute result; yet the relation between the quantities of carbon and hydrogen remained in all cases almost constant. Thus the specimen which contained most carbon gave

A. Carbon = 50.43
Hydrogen = 4.35 per cent.

And that which contained least gave

B. Carbon = 44.57
Hydrogen = 4.02

The number of atoms of carbon is to that of hydrogen in A as 6 to 3.17; and in B as 6 to 3.32. It is therefore evident that in both the thin and the thicker fluid the carbon and hydrogen are in very nearly the same ratio as that of C_6H_3. It is also certain that the thin fluid contains nitrogen either as nitric or hyponitrous acid, and we may construct from these principles the formula $C_6H_3O_4N$, which gives

Carbon	= 42.8	100.
Hydrogen	= 3.5	
Nitrogen	= 16.5	
Oxygen	= 37.2	

The formula $C_6H_3NO_4 = C_6H_3O + NO_3$; and represents a combination of oxide of pteleyl with hypo-nitrous acid, analogous to the nitrogen compounds existing in the napthaline and other series. The origin of this body may be very simply explained. It is probable that nitric acid unites directly with oxide of mesityl, but

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produces a compound, which is decomposed by the application of moderate warmth. Then, water being formed, there is

$$\left.\begin{matrix} NO_3 + C_6H_2O \\ -O_2 \quad -H_2 \end{matrix}\right\} = NO_3 + C_6H_3O;$$

the hypo-nitrite of pteleyl being produced.

I did not make any determination of the quantity of nitrogen in this body, as from the explosive way in which the decomposition went on, I did not conceive the result could be one deserving of much confidence.

XIII. OF THE MESITIC ALDEHYD.

I have mentioned that the thinner of the fluids generated by the action of nitric acid on mesitic alcohol, was rendered impure by the presence of a thicker substance, the quantity of which increased according as more red fumes were generated by the boiling of the mixture. This heavy thick fluid is the mesitic aldehyd; which, however, cannot be obtained pure in this way, as a considerable quantity of the hypo-nitrite of pteleyl remains unaltered. By means of the action of nitric acid on mesitylene, it may be obtained quite pure. When nitric acid is boiled with mesitylene, the latter is completely converted into a reddish yellow, thick, and heavy fluid, of a sweetish, but penetrating odour. When it appears no longer altered by fresh quantities of acid, it may be well washed with water, and dried by chloride of calcium.

The composition of this body was determined by the following analyses:

A. 0.385 fluid gave

0.243 water.
0.918 carbonic acid.

B. 0.410 of another quantity gave

0.266 water.
0.943 carbonic acid.

Whence the composition per cent.

	A.	B.	
Carbon	= 65.95	63.70	} 100.00.
Hydrogen	= 7.00	7.22	
Oxygen	= 27.05	29.08	

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The formula $C_6H_4O_2$ gives

$C_6 = 36.8$	64.8
$H_4 = 4.0$	7.0
$O_2 = 16.0$	28.2
56.8	100.0

The production of this substance, by the action of nitric acid, as well on mesitic alcohol as on mesitylene, is easily understood. Thus

$$\left.\begin{matrix} C_6H_6O_2 + NO_5 \\ -H_2 \quad -O_2 \end{matrix}\right\} = C_6H_4O_2 \text{ and } NO_3, \text{ which is expelled;}$$

and

$$\left.\begin{matrix} C_6H_4 + NO_5 \\ -NO_3 \end{matrix}\right\} = C_6H_4O_2.$$

$C_6H_4O_2 = C_6H_2O + HO$; hydrated oxide of pteleyl, or the aldehyd of the mesitic series.

This substance is but sparingly soluble in water; in an alkaline solution it instantly dissolves, giving a yellowish brown liquor. It absorbs dry ammonia with great rapidity, forming a brown, resinous-looking mass, which dissolves in water; and the solution, by cautious evaporation, yields crystals of the mesitic aldehyd ammonia. If a solution of this aldehyd ammonia be added to a neutral solution of nitrate of silver, there is immediately produced a yellow precipitate, which, when heated in the liquor, gradually grows black; the reduction is, however, in this way, imperfect. On the contrary, if the oxide of silver be separated, by a drop of water of potash, it is immediately reduced, the metal being deposited mostly as a black powder, and only partly and occasionally lining the interior of the tube. In no case is the mirror surface generated, which is produced in the reduction of silver by the aldehyd from ordinary alcohol.

There is no doubt but that an acid having the radical pteleyl C_6H_3, as its basis is here produced, by a reaction similar to that which forms acetic acid, in the reduction of silver by vinic aldehyd. I have not, however, attempted to isolate it, or to determine its identity with that resulting from other processes now to be described.

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XV. OF THE MESITIC CHLORAL.

The action of chlorine on mesitic alcohol has been examined by Matteuchi and by Liebig; the latter celebrated chemist has described with great accuracy the properties of the heavy oily matter thus formed, and to which I give the name of the Mesitic Chloral. He likewise published an analysis of it, which differs very little from the truth, although he states expressly that he does not bring it forward as correct, but merely as proving that the fluid in question contains chlorine, which Matteuchi had strenuously denied. The action of chlorine on pyroacetic spirit is accompanied by the disengagement of a large quantity of muriatic acid gas; when the action has entirely ceased, the liquor must be boiled to drive off the excess of muriatic acid which remains dissolved, and then dried by digestion on chloride of calcium. It can scarcely be distilled without undergoing alteration, becoming dark-coloured and opaque, while muriatic acid gas is disengaged. It boils at about 260°. Its odour is excessively irritating to the nose and eyes, producing profuse weeping, which lasts for several days; and some of it having accidentally spilled on the hand, produced reddening and vesication as complete as that by cantharides, but much more tedious in healing. On analysis:

A. 0.930 material gave

0.251 water.
0.958 carbonic acid.

B. 0.880 gave

2.028 chloride of silver.

Hence results the composition

Carbon	= 28.48	100.0.
Hydrogen	= 3.00	
Chlorine	= 56.83	
Oxygen	= 11.69	

Liebig's analysis gave

Carbon	= 28.0	100.0.
Hydrogen	= 2.8	
Chlorine	= 52.6	
Oxygen	= 16.6	

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In order to ascertain whether there was formed, by the action of small quantities of a base on this chloral, a body analogous to chloroform, I added to a certain quantity as much potash liquor as dissolved about one-half. The residual heavy fluid, which differed but very little in odour and appearance from its state before the action of the potash, was analyzed.

A. 0.500 material gave
0.164 water.
0.547 carbonic acid.

B. 0.774 material gave
0.841 carbonic acid.
0.241 water.

Whence follows

	A.	B.
Carbon	= 30.25	30.04
Hydrogen	= 3.64	3.44

As the quantity of carbon, remaining almost absolutely unaltered, proved the fluid analyzed to be unchanged chloral, it was thought unnecessary to determine the chlorine by itself.

The results just obtained may be considered as agreeing tolerably well with each of the following formulæ:

$C_6H_3O_2Cl_2$ gives

C_6 = 36.84	29.07
H_3 = 3.00	2.37
O_2 = 16.00	12.65
Cl_2 = 70.84	55.91
126.68	100.00

$C_6H_4O_2Cl_2$ gives

C_6 = 36.84	28.86
H_4 = 4.00	3.13
O_2 = 16.00	12.53
Cl_2 = 70.84	55.48
127.68	100.00

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The only remarkable difference, between these formulæ, consists in the proportion of hydrogen. It is very unusual, in an analysis of an organic substance, and particularly in that of one containing chlorine, to obtain too small a value for the hydrogen, as in general the error of experiment throws the quantity of hydrogen above the truth. Now here, Liebig, in an analysis, (on which, however, he warns us not to rely,) obtained 2.8; and I obtained in one case 3.0, whilst the theory of the latter formula is 3.13. But it must be recollected that, the first formula assigning 2.37 for the hydrogen, Liebig must have gotten 0.43, and I must have obtained 0.63, 1.27, and 1.07 of hydrogen too much, which is a supposition more improbable than the former.

From the reaction of the chlorine, we may explain the origin of the mesitylic chloral, on either formula; but the decomposition in the case of $C_6H_3O_3Cl_3$ is much more complex. Thus, we must consider the pyroacetic spirit, as really an alcohol, and that but one atom of its hydrogen pre-exists as water; and then, applying the principle of Dumas's theory of substitution, that atom is removed without being replaced, but the further elimination of the hydrogen is accompanied by the substitution of an equivalent quantity of chlorine. Thus

$$\left.\begin{matrix} C_6H_5O + HO \\ -H_2 + Cl_2 - H \end{matrix}\right\} = C_6H_3O_3Cl_3.$$

Taking the formula $C_6H_4O_3Cl_2$, the reaction becomes much more simple, and consists merely in the elimination of two equivalents of hydrogen, and their replacement by two of chlorine. This formula I am the more strongly disposed to admit, from the action of bases on the mesitic chloral.

When this mesitic chloral is put in contact with a base, there is produced a deep reddish-brown solution, the chloral disappearing completely, if the base be in excess; there is produced a large quantity of a metallic chloride, and a salt of the base employed with a new acid, the nature of which may be deduced from the circumstances of the reaction by which it is formed. The chlorine abandoning the other constituents of the mesitic chloral in order to unite with the metal whose oxide has been employed, it must be replaced by an equivalent quantity of oxygen, and the body $C_6H_4O_4 = C_6H_3O_3 + HO$ must be produced. Such may be expected to be the composition of the acid in the new salt produced; and until its nature and composition are more accurately examined by other chemists, it may

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receive the provisional name of *Pteleic Acid.* The salts which it forms are almost all soluble; those with the alkalies and alkaline earths are in solution coloured brown, but do not possess any of the reducing properties of the similar compounds of mesitic aldehyd.

In presenting this memoir to the Royal Irish Academy, I noticed the existence of two acids formed by the action of acetone on permanganate of potash. A salt is at first obtained quite neutral, which after a little time breaks up into a carbonate, and a salt of another acid. The investigation of the properties and composition of these, as well as the more minute examination of the compounds of the pteleic acid, will form the subject of another paper.*

* The principal Memoirs on Pyroacetic Spirit by previous authors are the following:—Derosne; Annales de Chimie, vol. lxiii. p. 267.—Chenevix; Annales de Chimie, vol. lxix. p. 5.—Macaire and Marcet; Bibliotheque Universelle, vol. xxiv. p. 126.—Matteuchi; Annales de Chimie et de Physique, vol. xlvi. p. 429.—Liebig; Annalen der Pharmacie, vol. i. p. 225.—Dumas; Annales de Chimie et de Physique, vol. xlix. p. 208.

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VIII. *On the Insulation of Fluorine.* By George James Knox, Esq., A.M., M.R.I.A., and the Rev. Thomas Knox, M.R.I.A.

Read 10th April, 1837.

THE composition of hydro-fluoric acid had been a subject of discussion among chemists until the year 1810, when M. Ampere, from considering the analogy which subsisted between this acid and muriatic, was led to draw similar conclusions with respect to the composition of each. Sir Humphry Davy was at first opposed to these views, but on further consideration, being led to change his opinion, he brought forward experimental proofs of their correctness, which may be found in the Philosophical Transactions.*

Having by these experiments demonstrated the probable existence of fluorine, he proceeded to other experiments with the view of obtaining it in an insulated state; for which purpose he heated fluoride of mercury and fluoride of silver in glass vessels, filled with chlorine; he obtained chloride of silver from the one, and corrosive sublimate from the other; and the vessels were found to be filled with fluosilicic acid and oxygen arising from the decomposition of the silica by the nascent fluorine. He obtained similar results when fluoride of potassium and fluoride of sodium were heated with chlorine.

When the same experiments were repeated in vessels of platinum and silver, the vessels were powerfully acted upon. In glass vessels, coated with cuprane and horn-silver, the chlorides were fused at the temperature required for the experiments, and the glass was acted on as before. In a platinum vessel coated with fluoride of potassium, a gas was obtained having an odour more disagreeable than that of chlorine; but the platinum was found to have been acted upon. Sir H. Davy made many other experiments with the view of decomposing hydro-fluoric acid by means of chlorine and oxygen, by passing these gases with the

* Phil. Trans. 1813, p. 263.

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vapour of hydro-fluoric acid through a platinum tube heated red hot; and by distilling it from salts containing abundance of oxygen or of chlorine. He distilled also the fluorides of lead and mercury with phosphorus and sulphur in glass tubes, with the formation of a phosphuret and sulphuret, and action on the glass; when the glass tubes were lined with sulphur, a limpid liquid condensed in a part of the tube cooled to zero.

From these experiments he concludes, that there exists in the fluoric compounds a peculiar element, possessed of strong attraction for metallic bodies and hydrogen, which from the low refractive power of hydro-fluoric acid, he supposed would have less refractive power than any substance known, possessing at the same time higher acidifying and saturating powers than either oxygen or chlorine, and which, when obtained in an insulated state, would prove to be a gas.

We understand that Sir H. Davy got vessels of fluor-spar made for the purpose of repeating these experiments, but since he has not published any which he may have tried with them, we conclude that he either did not employ them, or that they did not conduct him to any new results.

Such was the state of the subject till the year 1836, in the spring of which year we commenced the following investigation. Sir H. Davy's experiments having shown that chlorine would decompose fluoride of mercury in glass vessels, it became a question to determine whether the same result would take place in vessels upon which the nascent fluorine could exert no action. This we tried by heating dry chlorine with fluoride of mercury in two small perforated crystals of fluor spar. A chloride of mercury was formed. Then, in small vessels of fluor-spar containing chlorine, we heated fluorides of mercury, lead, and hydrofluate of ammonia; in the first were formed crystals of corrosive sublimate; in the second the fluoride of lead was not acted upon; and the last vessel was filled with vapour of hydro-fluoric acid. We then procured fluor-spar vessels of a larger size, lapped with wire, for the purpose of equalizing the temperature, and so preventing the vessels from splitting on a sudden application of heat. Instead of a flat cover for the vessels we had fluor-spar receivers made, the cavities of which were filled with ground-stoppers of fluor. On moving the receivers over the mouth of the vessel the stoppers fall in, and their places in the receivers are occupied by whatever the contents of the vessel may be. On the top of these vessels were three or four small depressions, in which were placed any substances that we wished to submit to the action of the gas, and over which the re-

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ceivers, when filled with the gas, could be slid. The results we came to with these vessels were the following:—Litmus paper was reddened, glass strongly acted upon, gold on one occasion slightly acted upon, owing, as we believe, to the formation of a fluoride of gold, as we were led to suppose by the action of the product on glass, when heated with sulphuric acid. From having ascertained the perfect dryness of the materials, and from the absence of moisture when the cover had been cooled down by the evaporation of sulphuret of carbon, we proved the absence of hydro-fluoric acid; and from having obtained bi-chloride of mercury, we inferred the disengagement of fluorine. These reasons alone, we conceived, would have been sufficient to justify us in supposing the insulation of fluorine.

It may be mentioned here, that after we had entered on our investigations, we met with a notice of some experiments made by M. Baudrimont, with the intention of insulating fluorine in glass vessels. He heated a mixture of fluor-spar and peroxide of manganese with sulphuric acid in a glass retort, and collected in a dry glass vessel a gas of a yellowish brown colour, which bleached litmus paper, and acted upon gold in the cold, differing from the gas that we have obtained in these qualities.

In the month of December last we had other fluor vessels constructed at Mawe's establishment, of a similar form to those already employed, but much larger size; they were lapped with fine iron wire, were of a very considerable thickness, and could contain about four fluid ounces; the upper part of these vessels was turned round, and reduced in thickness, so as to fit into a flat slab of fluor-spar, and the upper edge of the vessels was then polished off, so as to be on the same level with the flat slab, which acted as a table upon which the covers of the vessels and the receivers for the gas could be slid, without letting the contents mix with the atmospheric air. The receivers for the gases were square, about two inches and a half high, and one and a quarter wide, and the interior, which was circular, and about five-eighths of an inch in diameter, was fitted with a stopper of fluor. On opposite sides of these receivers (*see Plate*) holes were drilled quite through, intersecting the former cavity at right angles, and into these holes were fitted, air-tight, clear crystals of fluor, so that the colour of any gas in the receiver could be distinctly observed on looking through them. There were some small depressions in the flat slab, which we have above called *the table*, in which might be placed any piece of metal or other substance

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on which it might be wished to try the effect of the gas; one edge of the table was straight, so that a receiver full of gas could be removed on a slab of fluor without loss of the contents. The mode of using these vessels is as follows:—after the vessel with its contents has been heated gradually, so as to raise the temperature, and expel the water from the fluoride to be acted on, it is filled with dry chlorine, and a receiver is fastened down upon it with a weight or clamp; then the apparatus being heated to any temperature required, when we wish to examine the gas in the receiver, a second receiver, with a stopper in its cavity, is placed beside the first, and is slid on the table, till it occupies the place of the first; its stopper then falls into the vessel, and its cavity is filled with gas. This receiver, in like manner, is replaced by another, and so on till the vessel has been choked up with stoppers. The contents of the receivers can then be examined by being slid over various tests in the places made for that purpose on the surface of the table. The entire apparatus is supported on a stand over a lamp.

In recommencing the experiments in these new vessels, adapted for showing the colour of the gas in the manner above described, we found that when perfectly pure fluoride of mercury was used, the gas obtained was colourless; and to the upper part of the vessel inside, were suspended feathery crystals of corrosive sublimate. The gas obtained in the receivers has a heavy smell, not pungent or irritating, and thereby easily distinguishable from chlorine or hydro-fluoric acid. When exposed to the air it does not fume, which would be the case were the latter of these present.

With regard to its power of supporting combustion, red-hot wire appeared to become slightly brighter, but did not scintillate; we tried it also with burning charcoal and phosphorus, which latter was not extinguished; but these effects were very slight, and cannot be relied on as certain, as the atmospheric air must be admitted in plunging in the heated wire.

We attempted its detonation with hydrogen, thinking thereby to obtain hydro-fluoric acid. For this purpose we inserted two platinum wires through the opposite sides of a fluor-spar receiver, upon which, when filled with dry hydrogen, we placed a receiver of the gas obtained in the vessels. On passing a spark from a Leyden jar, detonation took place; there was an absorption, and on separating the vessels slight fumes appeared, from which we inferred that hydro-fluoric acid

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had been formed; but in moving the vessels over each other some air may have got in, which would account for the detonation. This was repeated frequently; but, from the nature of the manipulation, the result could not be depended on. On collecting and examining the gas that remained on one occasion, after detonation, there was no hydrogen found.

On placing many receivers filled with the gas in succession over water, whether hot or cold, the solution, if such, had all the properties of hydro-fluoric acid in acting on glass, reddening litmus, and giving precipitates with lime and barytes.

We passed some through hot water into a graduated glass tube. There was a considerable absorption, and a deposit of flakes of silica. The remaining gas, on examination, proved to be atmospheric air, with some oxygen. The admission of some atmospheric air in the transference is, from the nature of the vessels, almost unavoidable, for which reason the results must be received with caution.

When a receiver of the gas is placed over dry litmus and Brazil wood-papers, the former is reddened, the latter turned yellow, and *in no instance* were they ever bleached. When a receiver was placed over wet glass it was strongly acted upon. When the glass was carefully dried there was less action than before. From which circumstance, supposing that if the glass were perfectly dry, there would be no action upon it, we placed a small piece in a perforation in the interior of the receiver, and found it was still acted on, but not more so than when fluoride of mercury alone was in the vessel.

In trying the action on the metals we found it necessary to try the separate action of hydro-fluoric acid and sublimed fluoride of mercury, in order to distinguish the action that might be due to fluorine alone, from that which might be caused by their presence. Corrosive sublimate also, when in vapour, acts powerfully in many cases, and these two last substances must necessarily be always present. The hydro-fluoric acid was formed in the vessels themselves.

The results given in the following table, in the column headed Fluorine, are those which were produced on the various metals, over which a receiver, full of the gas, obtained in the usual way, had been placed.

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The Action on the various Metals by Fluorine, Hydro-fluoric Acid, and Vapour of Fluoride of Mercury.

	Fluorine.	Hydro-fluoric Acid.	Vapour of Fl. of Mercury.	OBSERVATIONS.
Gold	Action.	None.	None.	The action on gold was only obtained *once*, and that in the small vessels when greater heat was applied. The action was not obtained on the palladium without allowing the gas to act for some hours on it. Corrosive sublimate, at the heat applied, acts on antimony, though not on bismuth; so that bismuth, palladium, and, at high temperature, gold, seem to be the only metallic tests of the existence of the gas in the receivers.
Platinum . . .	None.	None.	None.	
Palladium . . .	Action.	None.	None.	
Rhodium . . .	None.	None.	None.	
Silver	Action.	Action.	Action.	
Mercury	Action.	Action.	Action.	
Lead	Action.	Action.	Action.	
Cadmium . . .	Action.	Action.	Action.	
Copper	Action.	Action.	Action.	
Bismuth	Action.	None.	None.	
Antimony . . .	Action.	None.	None.	
Iron	Action.	Action.	Action.	
Zinc	Action.	Action.	Action.	
Tin	Action.	Action.	Action.	

It is right to state here, that the action on the palladium and bismuth was not proved to be from the formation of fluorides of those metals, in consequence of the minuteness of the pieces used. That on the gold we have since confirmed by the action upon it by the battery.

In order to determine the relative attraction of fluorine for those metals upon which it does not seem to act except in the nascent state, we made platinum, palladium, gold, and rhodium successively constitute the positive pole of a battery of sixty pair of plates, electrolizing moistened fluoride of lead. The platinum was covered with a chocolate-coloured substance, which disappeared on heating. The action on the palladium gave rise to a reddish-brown colour, the same as that obtained before by the direct action of the gas. The gold was only occasionally acted upon,—the colour, brownish-red. The rhodium was never acted upon in the trials we gave it; so that if this should be confirmed, fluorine might probably be obtained in an insulated state by electrolizing a fluoride, using rhodium as the positive pole.

We repeated M. Baudrimont's experiments in glass, and in the vessels of fluor spar, but were unable to obtain a coloured gas having the properties which he describes. From the nature of his experiments, we conceive it to be impossible that the gas obtained by M. Baudrimont could be fluorine, on account of

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the water present, and consider it probable that it was a fluoride of oxygen formed by the union of the nascent oxygen and fluorine. To determine this, we heated in a dry glass tube a mixture of iodic acid and fluoride of mercury, supposing that when the iodine decomposed the fluoride of mercury, fluorine and oxygen being set free from their combinations with oppositely electrical bodies (mercury and iodine) would be in the most favourable condition for combining. On applying a moderate heat a yellow gas arose, which did not act on the glass, and bleached litmus paper slightly; on increasing the temperature, the yellow iodide of mercury sublimed, then iodine, and finally fluoride of mercury.

We have to remark, with regard to our present mode of manipulating, that about 100 grains of the fluoride of mercury is a sufficient quantity; but that its *absolute dryness* must be ascertained, which may be known by its subliming plentifully out of the mouth of the vessel. It requires about two hours to effect this, and to raise the temperature of the fluor vessel sufficiently high previous to passing in the chlorine. When filled with the chlorine, which must be also well dried, we apply the heat of Rose's spirit lamp, with circular wick, for about twenty minutes, which we find to be always sufficient for the decomposition of the fluoride. When we have examined the contents of the vessel, after a quarter of an hour, we have found chlorine in it, but *never* when it has been heated the above length of time. If, instead of drying the material perfectly, it happened that a trace of moisture was allowed to remain, then, instead of the usual result, we obtained copious fumes of hydro-fluoric acid.

In conclusion, we beg to state, that we are far from wishing it to be supposed that we consider the doubts on the nature of fluorine set at rest by the foregoing researches. But we think ourselves justified, from the experiments we have detailed, to conclude, that some advances have been made, and that a mode of operating on that element has been pointed out, which may be successfully employed hereafter, and which, in other hands, may lead to more complete results.

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EXPLANATION OF PLATE.

FIRST SET OF VESSELS, ONE-HALF OF THE ACTUAL SIZE.

Fig. 1.—The vessel.
Fig. 2.—Receiver and its stopper.
Fig. 3.—The whole, together with lamp, as when in use.

SECOND SET OF VESSELS, ONE-THIRD OF ACTUAL SIZE.

Fig. 4.—The vessel.
A.—The shoulder on which the table rests.
Fig. 5.—The table.
B.—The flat edge.
C.—The small depressions.
D.—Aperture in centre, through which the top of vessel is inserted.
Fig. 6.—The receiver.
E.—The clear piece inserted in the side.
H.—The aperture in which the stopper fits.
Fig. 7.—The stopper.
Fig. 8.—The whole apparatus, when put together on a tripod, with the receiver fastened down by a clamp.

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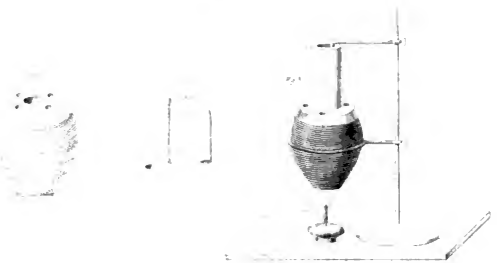
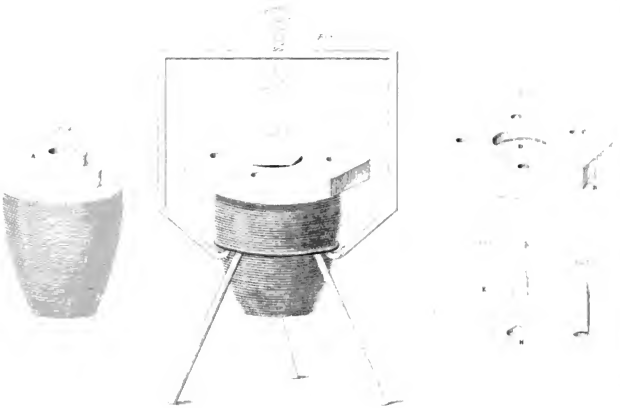
First set of vessels one half the natural size.



Second set of vessels one third of natural size.



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IX. *On the Composition of certain Essential Oils.* By ROBERT KANE, M.D., M.R.I.A., *Professor of Natural Philosophy to the Royal Dublin Society and of Chemistry to the Apothecaries' Hall of Ireland, Corresponding Member of the Society of Pharmacy and of the Society of Medical Chemistry of Paris, Honorary Member of the Society of Apothecaries of the North of Germany, &c.*

Read 12th June, 1837.

THE analyses, which constitute the material of this paper, were undertaken as the first step in a train of research, which had for its object the solution of two problems in organic chemistry, the importance of which will be at once recognized; namely, first, whether there exists a law connecting the composition of the oils derived from the same natural family of plants? and secondly, what is the chemical nature of the essential oils as a class? is the oil of bitter almonds a type for all? Towards a decision of these questions some materials have been collected; but the investigation embraces a field so wide, that considerable time must elapse, before even such general results, as have been already obtained, can be worked into a form fit for publication. In the meantime I am induced to lay before chemists those conclusions with respect to the composition of some of the oils, which may serve as data in a solution of the first question, and as initiatory to the more abstract considerations on their composition as a class.

1. COMPOSITION OF OIL OF ROSEMARY.

The oil of rosemary, obtained in its purest commercial form, is colourless, and possesses strongly the odour of the fresh plant. Its specific gravity is given by Brande 0.9118. I found the oil of commerce to be 0.897; but like all these oils it differs according to seasons, from the variable quantity of stearopten it may hold dissolved. When submitted to rectification it distils over, the boiling point rising, but not rapidly; and the last portion in the retort becomes brown,

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and of a thick consistence. By repeated distillations it can be rendered completely pure.

Its specific gravity is then from 0.8854 to 0.8875. Berzelius states the specific gravity of the pure oil to be 0.889. It boils at a temperature from 332° to 334° Fahr. Its boiling point is almost absolutely constant,—indeed much more constant than that of any other oil I have examined. It was analyzed in the ordinary way by combustion with oxide of copper, and the carbonic acid collected, by potash, in Liebig's apparatus.

A. Material = 0.300 gramme, gave

Water	= 0.315
Carbonic acid	= 0.907

B. Material = 0.247 gramme gave

Water	= 0.261
Carbonic acid	= 0.744

Hence follows

	A.	B.
Carbon	= 83.49	83.31
Hydrogen	= 11.66	11.66
Oxygen	= 4.85	5.03

These analyses, having been made with quantities of oil distilled at different times, and coinciding so completely, rendered it unnecessary to increase the number.

The above result is fully expressed by the formula $C_{45}H_{38}O_2$, which gives

C_{45}	= 276.3	83.63
H_{38}	= 38.0	11.54
O_2	= 16.0	4.83
	330.3	100.00

Evidently $C_{45}H_{38}O_2 = 9(C_5H_4) + 2HO$; that is, we may consider oil of rosemary as a hydrate of one of those numerous oils, agreeing in per-cent composition with oil of turpentine. This relation induced me to make some experiments on the action of various bodies on it, the results of which belong properly to a future memoir, but of which I shall transcribe one here.

When mixed with sulphuric acid, oil of rosemary becomes black, and neutralized

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by lime gives a soluble salt, which contains an acid belonging to the class composed of oxygen, sulphur, and an organic element. If the mixture of oil of rosemary and sulphuric acid be distilled, there is obtained a fluid possessing an aromatic, yet alliaceous odour, resembling that of mesitylene. When quite pure this fluid has a specific gravity 0.8678, and boils at about 344° Fahrenheit. It gives, on analysis, the same composition as oil of turpentine; but I shall defer the details to the memoir on the Chemical Habitudes of the Oils as a Class. To this fluid I have given the name of *Rosmarine;* but I have not determined its atomic weight, so as to be able to say whether oil of rosemary be a bi-hydrate of rosemarine, and its formula $C_{45} H_{30} + 2HO$. I use the word bi-hydrate here, merely in order to represent the abstraction of 2 HO by the sulphuric acid, and not wishing to involve any consideration of theory, which will be discussed in its proper place in the memoir already alluded to.

II. OIL OF MARJORAM.—(ORIGANUM VULGARE)

This oil is found in commerce nearly pure. Its specific gravity is variable; Mr. Brande found it 0.909; while I obtained 0.8901. This arises from the quantity of stearopten which it contains not being constant, though generally large. By rectification several times, so as to deprive it of the solid matter, it is obtained finally of the specific gravity 0.8673, the boiling point being almost completely constant at 322° F. In this state it was analyzed.

A. Material = 0.368 gramme gave
Water = 0.368
Carbonic acid = 1.154

B. Material = 0.2907 gramme gave
Water = 0.300
Carbonic acid = 0.905

C. Material = 0.2854 gramme gave
Water = 0.295
Carbonic acid = 0.891

D. Material = 0.2881 gramme gave
Water = 0.302
Carbonic acid = 0.898

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Hence there is per cent.

	A.	B.	C.	D.
Carbon	= 86.71	86.08	86.33	86.18
Hydrogen	= 11.11	11.44	11.44	11.64
Oxygen	= 2.18	2.48	2.23	2.18

These results are expressible by a very simple formula, $C_{30}\ H_{40}\ O$, or $10\ \{C_3\ H_4\} + O$, which gives

C_{30}	= 307	86.48
H_{40}	= 40	11.27
O	= 8	2.25

The first analysis deviates a little from this result, in the direction opposite to that generally taken by errors of experiment in organic analysis, but so trivially, that I am not inclined to attribute to it any importance. From the remarkable relation of the formula to that of oil of turpentine, it may, perhaps, be thought that possibly the oil of origanum had the same composition, and that the two per cent. attributed to oxygen, arose from the loss consequent on an imperfect combustion; but that idea is disproved by—first, the uniformity of the analyses which were made at different times and on different quantities of oil; and secondly, by the fact that in only the fourth analysis does the hydrogen amount to what oil of turpentine should yield, that is 11.55 per cent., the general error in analysis being to give too high a value for the hydrogen. The stearopten of this oil would appear to contain much more oxygen than the oil itself; as a quantity of oil which contained some, and had consequently a boiling point of 344°, gave the following results:

Material = 0.360 gramme gave

Water	= 0.350
Carbonic acid	= 1.100

Hence per cent.

Carbon	= 84.48	} 100
Hydrogen	= 10.80	
Oxygen	= 4.72	

being a mixture, it admits of no formula.

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III. OIL OF PEPPERMINT.

This oil had been submitted to analysis by Blanchet and Sell,* but their results having been communicated without any detail, and the analyses being exceedingly discordant, I was obliged to reexamine its constitution before I could satisfy my mind. The result has been, that I have obtained a formula differing from that of the chemists before named.

The oil of peppermint of commerce, particularly that sold as American, is often adulterated by a large quantity of oil of turpentine, from which, if once mixed, no number of rectifications can completely purify it. The rough oil, when pure, has, according to Brande, a specific gravity 0.907; I found it 0.9083. It contains a certain quantity of stearopten, though not so much as the generality of oils; when freed from this by repeated distillations it has a specific gravity of 0.8998, and boils between 370° and 380° Fahr.

The following are the analytical results:

A. Material = 0.2905 gramme gave
Water = 0.318
Carbonic acid = 0.812

B. Material = 0.3667 gramme gave
Water = 0.407
Carbonic acid = 1.035

C. Material = 0.3443 gramme gave
Water = 0.375
Carbonic acid = 0.969

Hence there is per cent.

	A.	B.	C.
Carbon	= 77.29	78.06	77.81
Hydrogen	= 12.11	12.32	12.01
Oxygen	= 10.60	9.62	10.18

The analyses A and B were made with the same specimen of oil; the correct value for carbon is therefore that of B. The analysis C was made subsequently with a different specimen.

* Journal de Pharmacie, vol. xx. 1834.

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The formula $C_{21} H_{20} O_2$ gives

C_{21} =	128.9	78.14	100
H_{20} =	20.0	12.12	
O_2 =	16.0	9.74	

I cannot explain the difference between this result and that of Blanchet and Sell, as they give no account of the circumstances under which their analyses were made. They make no mention of having submitted their oil to rectification. Their result is $C_{12} H_{10} O$, and per cent.

	Experiments.	Theory.	
Carbon =	79.63	80.35	100
Hydrogen =	11.25	10.90	
Oxygen =	9.12	8.75	

Blanchet's result for the stearopten of oil of peppermint, though discordant with itself, yet approaches closer to mine for the oil. Thus he obtained for the solid crystalline stearopten $C_{20} H_{18} O$, and per cent.

	Experiments.		Mean.	Theory.	
Carbon =	79.63	77.27	78.45	77.28	100
Hydrogen =	11.25	12.96	12.11	12.59	
Oxygen =	9.12	9.77	9.44	10.12	

On analyzing the first portion obtained in rectifying oil of peppermint, which had a boiling point about ten degrees lower than the general mass subsequently condensed, I obtained the following result:

Material = 0.337 gramme gave

Water	= 0.360
Carbonic acid	= 0.969

Hence per cent.

Carbon	= 79.53
Hydrogen	= 11.86
Oxygen	= 8.61

This result might be considered as approximating to that of Blanchet; but this portion could not be considered as being pure oil, as it constituted not a tenth of the quantity submitted to distillation. I attributed its different composition to an adulteration by oil of turpentine, which from its greater volatility came over in the commencement. If the oil of turpentine were in large quantity, a complete rectification could not be obtained.

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Upon the whole it is evident, that we cannot consider the nature of the oil and stearopten of peppermint as being absolutely determined; at the same time, I conceive myself justified in placing some confidence in my results, from their agreement, and the care with which the substance had been purified.

IV. OIL OF PENNYROYAL.—(MENTHA PULEGHIUM)

The oil of pennyroyal is stated by Mr. Brande to have a specific gravity of 0.939. I could not obtain it in commerce with a specific gravity higher than 0.9271. I consider, however, the specimens having that specific gravity as being pure, and that a higher density arises from dissolved stearopten. The oil of 0.9271 having been rectified, left but little solid matter; and the pure oil, after distillation, had a specific gravity of 0.9255. Its boiling point could not be obtained quite constant, fluctuating between 360° and 370° Fahr. At the end of this paper a few remarks on the boiling points of these oils will be found. It was analyzed as follows:

A. Material = 0.3607 gramme gave
Water = 0.353
Carbonic acid = 1.020

B. Material = 0.3014 gramme gave
Water = 0.297
Carbonic acid = 0.861

Hence per cent.

	A.	B.	
Carbon	= 78.2	79.0	100.0
Hydrogen	= 10.8	10.9	
Oxygen	= 11.0	10.1	

These analyses give the formula $C_{10} H_8 O$, or

Carbon	= 61.4	79.30
Hydrogen	= 8.0	10.35
Oxygen	= 8.0	10.35
	77.4	100.00

This result is exceedingly remarkable, as from it follows that oil of penny-

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royal has the same composition as camphor, and as the new substance described by me in the memoir on Acetone, and which I have termed *Dumasine*.* A very interesting problem, which I hope soon to be able to solve, will be, to determine the relative changes which dumasine and oil of pennyroyal undergo, in the circumstances under which common camphor yields camphoric acid.

Oil of pennyroyal is more frequently adulterated with oil of turpentine, and to a greater extent, than any other oil that I know of. I have found specimens, which delivered four-fifths of their volume of pure oil of turpentine on rectification. Thus, in the commencement of these experiments, I isolated and analyzed quantities of the product of rectification of commercial oil of penny-royal, and stated verbally at a meeting of the Academy, that I could not find any difference between rectified oil of pennyroyal and oil of turpentine. I shall detail a couple of the analyses, made under those circumstances, because the result may be used as a test for the closeness of the other experimental results, and for the legitimacy of the formulæ deduced from them.

Fluid obtained by rectifying impure oil of pennyroyal, specific gravity = 0.8673; boils constant at 315°.

A. Material = 0.2183 gramme gave
Water = 0.232
Carbonic acid = 0.697

B. Material = 0.2433 gramme gave
Water = 0.260
Carbonic acid = 0.779

Hence

	A.	B.	Theory.
Carbon	= 88.29	88.56	88.45
Hydrogen	= 11.78	11.87	11.55

Its formula $C_5 H_4$. It was oil of turpentine.

* It had been my intention to insert the account of the composition and properties of Dumasine as an appendix to the memoir on Pyroacetic Spirit, but it has been withheld in order, when further studied, to form the subject of an independent paper. A notice of its discovery and composition was published in the Proceedings of the Royal Irish Academy, No. IV. page 61, and copied from thence into the Philosophical Magazine for 1837.

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V. OIL OF SPEARMINT.—(MENTHA VIRIDIS.)

The oil of spearmint is stated by Brande to have a specific gravity 0.939. That which I found in commerce had, in the rough state, a specific gravity 0.9142, and when freed by distillation of a considerable quantity of stearopten, 0.876. It boiled pretty constantly at 320° F. It gave by analysis as follows:

A. Material = 0.3087 gramme gave
Water = 0.311
Carbonic acid = 0.954

B. Material = 0.350 gramme gave
Water = 0.350
Carbonic acid = 1.075

C. Material = 0.4284 gramme gave
Water = 0.439
Carbonic acid = 1.327

Hence the per cent. composition:

	A.	B.	C.	
Carbon	= 85.44	84.94	85.66	} 100.0
Hydrogen	= 11.19	11.11	11.38	
Oxygen	= 3.36	3.95	2.96	

These results give the formula $C_{25} H_{28} O$; that is,

C_{25}	= 214.9	85.67	} 100.0
H_{28}	= 28.0	11.15	
O	= 8.0	3.18	
	250.9	100.0	

This formula, like that of oil of origanum, may be represented by a multiple of oil of turpentine + oxygen = 7 $\{C_5 H_4\}$ + o. It is however impossible to make any deduction from these facts with respect to its nature.

VI. OIL OF LAVENDER.—(LAVANDULA SPICA.)

The oil of lavender is remarkable for containing, probably, more stearopten than any other essential oil, the quantity itself being variable with the season and

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with the climate. Thus, in the oil from the south of Europe (Murcia), it is said to amount to more than one-half its weight, and I have often found a fourth of the English oil to remain behind on distillation, so loaded with stearopten as to become quite solid on cooling. These circumstances,—the quantity of solid matter, and its not differing very much in volatility from the oil,—present great obstacles to the obtaining oil of lavender in an absolutely pure condition.

The oil examined by Mr. Brande, and which probably contained much stearopten, was found by him of a specific gravity 0.9206. In the specimen which I tried the specific gravity was 0.9174. By repeated rectifications, by which as much of the solid matter as possible was separated, it was obtained 0.8865, and then boiled at 370° F. Another portion equally rectified had a specific gravity 0.8745, and boiled at 365° F. Saussure, who likewise examined this oil, states its specific gravity, when pure, to be 0.877.

A specimen of the commercial oil, the specific gravity of which was 0.9172, was rectified, and the product received in four different vessels, stopping when the residue in the retort appeared to become thick.

No. 1 had sp. gr.	= 0.8864	All boiled between 360° and 370°.
2	= 0.8879	
3	= 0.8884	
4	= 0.9050	boiled at 390°.

The residue solidified by cooling. The difficulty of pronouncing on the absolute purity of any one portion of oil of lavender is thus evident.

The analysis of this oil was conducted in the usual way. Different portions of oil were selected, in consequence of their boiling points and specific gravities not being in accordance.

A. Specimen sp. gr. = 0.8865; boiling point = 370° F.

Material = 0.4333 gramme gave

Water	= 0.441
Carbonic acid	= 1.245

B. Specimen sp. gr. = 0.8745; boiling point 365°.

Material = 0.2835 gramme gave

Water	= 0.299
Carbonic acid	= 0.819

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C. Specimen sp. gr. = 0.8864; boils at from 365° to 370°.

Material = 0.3788 gramme gave

Water	= 0.394
Carbonic acid	= 1.079

Hence the composition

	A.	B.	C.
Carbon	= 79.45	75.77	78.81
Hydrogen	= 11.30	11.73	11.55
Oxygen	= 9.25	12.50	9.64

As it is quite evident that, the heavier this oil is, the more stearopten it contains, and consequently, the less pure it is; and as, by Dumas's analysis, stearopten, if not completely identical, has at least the same composition with common camphor, I am inclined to consider the high values for carbon in the oils used in analyses A and C as owing in great part to its presence, and to assign the analysis B as a closer approximation to the composition of the pure oil. With this idea agrees Saussure's old result, who from an oil of the sp. gr. 0.877 obtained the composition

Carbon	= 75.50	100.0
Hydrogen	= 11.07	
Oxygen	= 13.07	
Nitrogen	= 0.36	

The nitrogen being now acknowledged to result from imperfections in the method employed, the tendency of which was also generally to give an underestimate for the amount of hydrogen, his result is found to agree with that of analysis B; but whether from both oils being pure, or from both being equally impure, I cannot undertake to say.

Under such circumstances it is scarcely useful to attempt the construction of a formula, as representing the result obtained. $C_{15}H_{14}O_2 = 3\,C_5H_4 + 2\,HO$, may, however, be employed:

Thus,

C_{15}	=	92.1	75.5
H_{14}	=	14.0	11.5
O_2	=	16.0	13.0
		122.1	100.0
			x 2

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I must not be understood as stating positively this formula to represent the truth.

ADDITIONAL REMARKS.

There is a peculiarity in the method of ebullition of these oils which renders it very difficult to fix upon a certain fixed temperature as the boiling point, but rather compels us to consider the oil as boiling within a limit of temperature, sometimes extending to ten degrees of Fahrenheit. Thus, in taking the boiling point of an oil in a tube, a thermometer being immersed therein to some distance above the bulb, the oil will enter into full ebullition apparently at 355°, and the temperature of the thermometer, on continuing the boiling for five or ten minutes, will gradually rise to 360° or 365°, and will not then stop so completely, but that an ebullition continued for five or six minutes more, may produce a further rise of a couple of degrees. If the oil be allowed to cool, and be then again heated, the same phenomenon will be repeated, and so, as often as may be wished; but the most colourless oil, when thus frequently heated, gradually becomes brown, and then there is a permanent elevation of the boiling point, arising from decomposition.

I attribute this phenomenon to an unequal distribution of heat through the mass, and to the heat being supplied by the spirit lamp too rapidly to be carried off from the oil by the vapour formed at the limited surface of contact of the oil with the air in the tube. This is supported by the fact, that by moderating the heat the boiling point may be kept constant; but, by a suitable heat, it may be kept constant at any degree, between the limits already alluded to. This is the reason why the boiling points of the oils analyzed are generally given within a limit of a few degrees. Some cases where the boiling points were almost really constant, I attribute to a closer approach to absolute purity in the oil.

A great deficiency exists in analytical results obtained under circumstances such as those described in the present paper, from the total want of a control over their exactitude; and one or two words on the nature of these controlling results, with reference to obtaining such in our experiments, may be here of use. There are four modes of control—1st, by synthesis, which is the most complete, but which in organic chemistry is attainable only in some very few

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cases. Of these few, the synthesis of urea, and that of acetic acid, may be taken as illustrations. 2nd, The method next in completeness is the breaking up of the body into other compounds whose composition is already known; as, formal into formic acid and methylic alcohol; acetal into acetic acid and vinic alcohol; acetic acid into carbonic acid and acetone. 3rd, The determination of the atomic weight of the body, by the compounds into which it enters with other well known substances. Thus the composition of oxalic ether controls the analysis of sulphuric ether, and the salts of the vegetable alcaloids give the only means of verifying the composition of the base itself. The fourth method of control is limited to such bodies as pass into vapour without being decomposed, and then the density of the vapour should stand in some simple relation to the sum of the densities of the constituents, taken in the atomic proportions given by analysis. Thus the discussion as to whether napthaline was represented by the formula $C_5 H_4$ or $C_8 H_3$ was decided by the vapour possessing a density immediately following from the former, but inconsistent with the latter. That, however, we must not insist on very simple relations, is shown by the complex numbers found for some of the inorganic compounds by Mitscherlich and Dumas.

Now in examining the composition of the oils, we are debarred from efficiently exerting any of these methods of control:—1st, we cannot generate them by synthesis; 2nd, we do not as yet know their chemical nature sufficiently to break them up into other bodies with which we can get more definite results; and 3rd, their combinations with other bodies have not been as yet developed. Towards the application of these methods I have made some progress in the cases of oils of rosemary, lavender, and oil of turpentine, which all give with sulphuric acid and a base, soluble salts, of which that from turpentine alone has been completely analyzed. The atomic weight of turpentine from the salt of lime is found to be $C_{20} H_{16}$; the same as from artificial camphor; and the salt has the composition $SO_3 . CaO . + C_{20} H_{16}$, belonging to a series distinct from the sulpho-vinates on the one hand, and the sulpho-napthalates upon the other, and being probably an analogue to the sulpho-mesitylic acid described in my memoir upon Acetone. I mention these results, although they properly belong to a different paper, in order to point out the probable means of applying the methods of control to the essential oils in future investigations. I attempted very often to determine the densities of the vapours of the essential oils with a bath of

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chloride of zinc, but I never obtained a result on which I could with satisfaction rely. The residual oil was evidently altered in its nature and appearance, and there always remained in the globe a certain quantity of permanent gas. I attribute the imperfect success of these attempts, to the mutual action of the oil and air of the globe at the high temperature necessary for the experiment; but by a modification of the apparatus I may possibly at a future period succeed.

A circumstance connected with the purification of the oils employed in the analyses detailed in this paper requires some notice here, as it has not been adverted to under the special heads; namely, the means used to secure the perfect freedom of the oils from water. This is the more important, as particularly in the results obtained with the oils of marjoram and spearmint, the small quantity of oxygen might be conceived as being derivable from this source, unless proper precaution had been taken. The oils, previous to rectification, were in all cases digested for several days on recently fused chloride of calcium; then poured off, and distilled; and the portions selected for analysis allowed to remain in contact for about twelve hours with a few pure fragments of chloride of calcium, before being used. In no case did the oil appear to act on, or dissolve any of the fused salt; and hence it was only necessary to pour the oil off from the chloride, and not to again distil it, in order to obtain it pure.

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X. *On the Properties of Voltaic Circles, in which concentrated Sulphuric Acid is the Liquid Conductor.* *By* THOMAS ANDREWS, M.D., *Professor of Chemistry in the Royal Belfast Institution.*

Read 9th April, 1838.

THE remarkable discovery of Professor Schœnbein of Bâle respecting the modification which the chemical action of nitric acid upon iron undergoes when they are brought into contact under certain voltaic conditions, has led me to examine the general phenomena which are exhibited by voltaic circles whose liquid conductor consists of a concentrated acid. In a paper read at the last meeting of the British Association, I showed that the solution of the oxidable metals in strong nitric acid is greatly retarded when they are voltaically associated with such metals as platina, upon which that acid has no action; a result which is evidently the reverse of the ordinary effect of the passage of an electrical current. The object of the present communication is to extend the same principle to the action of concentrated sulphuric acid under similar conditions, and to investigate some of the circumstances which influence the development of electrical currents in this way.

When a piece of zinc is introduced into strong sulphuric acid (sp. gr. 1.847) at common temperatures, its surface becomes covered with a mass of gaseous bubbles, so fine that they might be almost mistaken for a white precipitate, which very slowly separate from the zinc, but by agitation, or the application of a gentle heat, may be easily removed. The gas thus disengaged is hydrogen in a state of perfect purity. On applying heat to the acid there is scarcely any further extrication of gas, till the temperature has reached nearly 100° cent., when a very fine stream of gas begins to arise from the surface of the zinc. As the heat is raised, the quantity of gas becomes more considerable; from 120° to 150° cent. there is a rapid effervescence, and at still higher temperatures vast quantities of

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gas, mixed with the vapours of sulphur, are disengaged. On examination, this gas was found to consist of a mixture of sulphurous acid and hydrogen gas. When an excess of zinc was employed the hydrogen in the beginning of the process amounted to 20 per cent. of the whole, but towards the end it increased to nearly 40 per cent.

A similar portion of zinc being connected with a platina wire, and the free extremities of each being introduced into the same acid, so as to form a voltaic circle, the fine bubbles before described now appeared chiefly on the surface of the platina. When removed they did not form again, unless a fresh surface of zinc was exposed. The gas thus obtained was found to be pure hydrogen. The acid was then heated, but there was no extrication of gas from the surface of either metal till the temperature reached 150° cent., and then only a few minute streams arose from the platina wire. At 190° the evolution of gas from the platina wire did not exceed that from the unconnected zinc at 140° or 150°. From 210° to 240° there was rapid effervescence. During the course of the experiment no gas appeared at the surface of the zinc, unless the temperature was very high, so that torrents of gas were disengaged from the platina, when by a close inspection some very fine streams might be perceived forcing a passage from certain points of the zinc surface. The gas extricated from the surface of the platina differed from that obtained when the zinc alone was dissolved,—in the small quantity of hydrogen which it contained, and in that quantity diminishing instead of increasing as the solution proceeded. In fact the hydrogen was found to amount to 9 per cent. in the commencement of the experiment, and towards the end it diminished to only 1 per cent., the rest of the gas being sulphurous acid. A quantity of sulphur was also separated, both when the zinc was alone and connected with the platina, which sometimes appeared in crystals in the acid, at other times became diffused through the mass of the liquid, so as to render it nearly opake, while at high temperatures it was disengaged in the state of vapour.

Gold and palladium act in the same manner as platina.

There was no apparent difference in these results, whether pure zinc, or the sheet zinc of commerce was used, and from the uniform surface which it exposes, the latter was employed in all the following experiments.

To ascertain with precision the retarding influence of the platina upon the

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solution of zinc, similar portions of connected and unconnected zinc were exposed to the action of sulphuric acid of sp. gr. 1.845 at the same time and in the same vessel. The platina was placed opposite to both surfaces of the zinc, and at the distance of one-fourth of an inch; it exposed to the liquid a surface which was about one-third of that of the zinc. The connexion was made above the liquid. The following table contains the results of a series of experiments made at different temperatures, in which the second column gives the ratio of the quantities of zinc dissolved from equal weights of that metal, when alone and when united to platina, assuming as unit the quantity dissolved in the latter case.

No. of Experiment.	Ratio of Zinc dissolved.			Temperature.
	Connected.		Alone.	
1	1	:	2.065	168° to 170° cent.
2	1	:	2.255	203° to 206° ,,
3	1	:	2.347	221° to 233° ,,
4	1	:	3.000	238° to 240° ,,
5	1	:	3.208	242° ,,
6	1	:	1.478	250° to 270° ,,
7	1	:	1.335	265° ,,

Although the zinc was removed from the acid, and its loss ascertained, before its surface had undergone much alteration, yet as the connected zinc diminished less during the process of solution than the other, the surfaces became no longer precisely similar; and hence the differences exhibited by the table are less than they ought to be. From an inspection of the table, it appears that the greatest difference in the quantity of zinc dissolved occurs at the temperature of 242°, where the action of the acid is reduced to less than one-third by the contact of the platina; while at higher and lower temperatures the difference is less considerable. This circumstance may, perhaps, be explained by the following considerations. The rapidity of the solution of zinc, whether alone or connected, increases at a much faster ratio than the temperature, till it reaches a maximum point, when it can scarcely be augmented by farther increments of temperature. Now the effect of the contact of platina being to reduce the rate of solution of the zinc in the acid at a given temperature, (to what it is at 40° or 50° cent. lower than when unconnected,) it is evident that the difference will increase till they

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both attain such a temperature that they dissolve with the greatest possible rapidity when the difference will undergo a diminution.

The effect of the distance of the platina and zinc plates from each other in the acid was next investigated.

Two couples of platina and zinc, similar in every respect, except that in the one, the zinc plate and platina were in contact, and in the other, at the distance of .1 inch, were introduced into sulphuric acid, at the temperature of 225° cent. The quantity of zinc dissolved in the first couple was to that dissolved in the second as 1.587 : 1. When the distances between the platina and zinc were .1 and .5 inch respectively, the quantities of zinc dissolved were as 1.441 : 1. The temperature in this case was 230°. The galvanometer needle was also more strongly deflected when the metals were near each other. The action of the acid on the zinc therefore increases with the proximity of the platina, as in common voltaic circles. This is further shown by the parts of the surface of the zinc which are nearest the platina dissolving most rapidly.

Next the distance between the platina and zinc plates being the same, the extent of the platina surface in each couple was varied. The results obtained are exhibited in the following table, in which the second column shows the distance between the platina and zinc in the acid; the third, the extent of the platina surface in each couple referred to that of the zinc as unit; the fourth, the ratio of the platina surfaces to each other; the fifth, the ratio of the quantities of zinc dissolved with the respective platina surfaces; and the sixth, the temperature.

No. of Experiment.	Distance between Plat. and Zinc.	Plat. surface, Zinc = 1.	Ratio of Plat. sur.	Ratio of Zinc dissolved.	Temperature.
1	$\frac{1}{4}$ inch.	2.3 : 3.4	1 : 1.5	1 : .878	225° c.
2	$\frac{1}{4}$ „	4 : 12	1 : 3	1 : .890	230°
3	$\frac{1}{2}$ „	.1 : .4	1 : 4	1 : .872	225°
4	$\frac{1}{2}$ inch.	.1 : .7	1 : 7	1 : .920	230°
5	$\frac{1}{2}$ „	.13 : 2	1 : 15	1 : .892	205°
6	$\frac{1}{10}$ „	1 : 9	1 : 9	1 : .857	180°

Although the variations in the extent of the platina surfaces, both when compared to each other and to the surface of the zinc, are very considerable, yet the quantities of zinc dissolved present only slight differences, and do not appear

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to be influenced by those changes in the platina surfaces. It must, however, be particularly observed, that there is invariably less zinc dissolved with the larger platina plate,—a result altogether at variance with the established laws of voltaic action.

To ascertain whether this apparent anomaly depended upon some peculiarity in the mode of generation of these currents, or on the ordinary action of the acid on the zinc being more completely checked by the broader platina surface, it appeared to be necessary to determine the quantity of electricity actually developed under these conditions. For this purpose a galvanometer, composed of a pair of astatic needles, with a single silver wire between them, was interposed in the course of the circuit. As the needle of such an instrument can scarcely be maintained in a stationary position, but oscillates through an arc of two or three degrees round a fixed point, the most accurate method of ascertaining its deflection is to make five or more observations of the extremities of the arcs through which it vibrates, and to take a mean of the whole; and this was the method followed in obtaining the deflections contained in the next table. As each degree of the scale occupied only one-fortieth of an inch, and was not subdivided into smaller parts, it was difficult to avoid an error of a quarter of a degree in making the observations. The second column of the annexed table gives the extent of the surface of the platina exposed to the liquid, that of the zinc being represented by 1; and the third column, the deflection of the needle of the galvanometer. The temperature was 156° c. during the whole course of the experiment, and the distance between the zinc and platina surfaces was one inch and a half.

No. of Experiment.	Platina Surface, Zinc being = 1.	Deflection.
1	.8	30°.1
2	.2	29°.8
3	.08	30°.1
4	.02	29°.9
5	.01	27°.4
6	.008	26°
7	.0008	14°.2

The trifling differences in the deflections of the needle, in the first four experiments, certainly depended upon the unavoidable errors of observation and minute variations in the temperature of the acid. The current was therefore

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not perceptibly affected by altering the extent of the platina surface exposed to the liquid, unless that surface was reduced to less than $\frac{1}{10}$ of the surface of the zinc; and even when it amounted to $\frac{1}{1000}$ of the latter, the deflection of the needle was only one-half less than with equal surfaces. This is very different from the well-known effect of similar changes in the extent of the surface exposed by the electro-negative metal in voltaic circles formed with the dilute acids. As a term of comparison, the platina surfaces used in experiments 1 and 4, being connected with similar zinc plates as before, and introduced into a mixture of dilute nitric and sulphuric acids, the deflections were 25°.5 and 7° respectively.

Although there was no visible disengagement of sulphurous acid gas from the zinc in the preceding experiments, except in No. 7, yet by comparing these results with those before obtained, it will appear that increasing the platina surface tends to arrest more completely the ordinary or local action of the acid on the zinc.

When a slip of zinc in heated sulphuric acid was made the positive pole of a galvanic battery of twenty pairs of plates in moderate action, sulphurous acid ceased to be evolved from its surface, and the solution of the metal was greatly retarded.

As a contrast with the preceding results, the influence of mercury, in connexion with zinc, upon the solution of the latter metal, may be mentioned. If these metals are heated separately in concentrated sulphuric acid, till a gentle effervescence occurs at the surface of both, and then brought into contact, a very violent chemical reaction instantly occurs, an amalgam appears at first to be formed, and afterwards the zinc dissolves with the utmost degree of violence. It is the most remarkable example of increased chemical action from the formation of a voltaic combination with which I am acquainted. These facts are the more singular, as it thus appears that the influence both of amalgamation and of contact with platina on the solution of zinc is reversed in dilute and concentrated sulphuric acid.

The general phenomena presented by the other metals capable of decomposing sulphuric acid were similar to these already described in the case of zinc, but in the details there were some important points of difference.

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Two similar *iron* wires, I and I', were placed in a glass tube containing concentrated sulphuric acid, I being alone, and I' connected with a platina wire finer than itself. When first immersed in the acid the fine bubbles before described appeared at P and I, none at I'. On heating the liquid vast volumes of gas were extricated from I, but there was no gas visible at P or I' till the liquid was raised nearly to the point of ebullition, when there was some effervescence at P, and slight local disengagement of gas at I'.

When pencils of *tin*, T and T', (T being unconnected, and T' connected with the platina P, and similar designations are used for the following metals,) were substituted for the iron wire; the same phenomena occurred in the cold acid as with zinc and iron. Heat being applied to the acid, gas appeared at the same time at T and P; but on raising the temperature a little higher, the action suddenly became so violent on T that it was impossible to observe the surfaces of T' and P. By heating T' and P in a separate tube, the quantity of gas at P became very considerable, but far less than that before given off from T. There was also an obvious extrication of gas from T'.

With *bismuth* no gas appeared in the cold. On applying heat the surface of B became covered with a dark film, and soon afterwards that of B'. Continuing to apply the heat, gas was disengaged from P and B, but in much greater quantity from the latter. There was very little gas from B'.

Antimony gave precisely similar results to bismuth, except that there was rather more gas extricated from the metal connected with the platina when the temperature was high.

With *silver* no gas appeared in the cold. On applying heat S and S' became dark nearly at the same moment; as the heat was raised, gas was abundantly disengaged from S, and in smaller quantities from S' and P, but in the case of this metal the quantities of gas extricated from S' and P appeared to be equal.

With *arsenic* and *mercury* there was no action in the cold. When the acid was heated the disengagement of sulphurous acid appeared to be scarcely, if at all, diminished, by connecting these metals with platina. The quantity of gas also extricated at the surface of the platina was very trifling.

Taking a general view of these results, it will be observed, that the evolution

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of hydrogen gas, on immersion in the cold acid, occurred only with the metals, zinc, iron, and tin. The phenomena exhibited in this case by the platina and zinc couple afford a remarkable example of the cessation of a chemical action from the surface of the zinc acquiring a peculiar or polarized state. For although a large mass of bubbles appeared at first, yet by heating gently the liquid these not only were separated, but not the least trace of gas afterwards appeared at either surface. There is a striking analogy in this, to the action of nitric acid of certain strengths upon some of the metals.

In the cases of iron and zinc, the disengagement of gas was wholly transferred from the surface of these metals to that of the platina in connexion with them; in those of bismuth, antimony, and tin, there was slight extrication of gas at the surface of the dissolving metal; in that of silver, the quantity of gas was nearly the same from the platina and silver; while in the cases of arsenic and mercury, scarcely any gas was given off from the platina, the action of the acid on the two latter metals not being perceptibly diminished by contact with platina.

If these results are compared with those which have been already obtained with nitric acid, it will be evident that in the case of the concentrated acids the formation of a voltaic circle has in general the tendency to diminish chemical action. The following law will be found to be generally, although not universally true, the exceptions to it being probably, however, rather apparent than real.

The ordinary chemical action of an oxy-acid upon the metals soluble in it, is, in general, diminished when the acid is concentrated, by voltaically associating them with certain electro-positive metals; but on the contrary, is increased when the acid is dilute.

In the preceding experiments the diminution of chemical action occurred in cases in which the acid itself suffered decomposition; while in common voltaic circles, where it is well known that the action is increased, the elements of water alone are eliminated; but how far this coincidence may be universal, must be determined by future investigations.

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XI. *On a new Variety of Alum.* *By* JAMES APJOHN, M.D., M.R.I.A., *Professor of Chemistry in the Royal College of Surgeons, Ireland.*

Read 10th April, 1837.

THE mineral to which I am about to draw the attention of the Academy was given me by Mr. Smith of College-green, but I have since received a larger specimen of it from W. G. Atherton, Esq., a young gentleman who recently arrived in Dublin from the coast of Africa, for the prosecution of his medical studies, and who informed me that it occurs about midway between Graham's Town and Algoa Bay, in beds of considerable extent, and composed of a number of strata, whose aggregate thickness in some places amounts to at least twenty feet. It closely resembles satin spar, or the finer forms of amianthus. The threads or fibres of which it is composed, and which are very easily separated from each other, are about six inches in length, perfectly transparent, and possessed of a beautiful silky lustre. Upon exposure to air, however, they gradually lose this lustre, and become opake on the surface, owing to efflorescence. The taste is astringent and sweet, or almost identical with that of common alum. The specific gravity = 1.727, and the aqueous solution reddens litmus, and gives white precipitates, with nitrate of barytes, and caustic potash. These latter properties belong also to common alum. The precipitate, however, afforded by the caustic potash was but partially dissolved by an excess of the alkali, and the residue, though white at first, gradually became brown. A slight examination was sufficient to show that this matter was oxide of manganese, and that the alkali held alumen in solution.

Having thus established the presence in the mineral of sulphuric acid, alumen, and protoxide of manganese, it became highly probable that it was an alum in which the alkali was replaced by oxide of manganese. But before drawing such a

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conclusion, it was necessary first to investigate the proportions of the three constituents just mentioned; and, secondly, to determine whether the alkali was or was not altogether absent.

To resolve the latter question, 30.13 grains were dissolved in water, and treated first with ammonia, which threw down the alumen and greater part of the manganese, and then with sulphuretted hydrogen, to complete the precipitation of the latter base. The whole was then thrown upon a filter, and the mixed precipitates being well edulcorated with distilled water, the washings were evaporated to dryness in a porcelain capsule, and then transferred to a counterpoised platinum crucible, in which they were ignited. The residue weighed but .31 of a grain, and upon examination proved to be sulphate of magnesia, with a scarcely appreciable trace of sulphate of lime, in all probability derived from the filter. Hence, as

30.13 : ,31 :: 100 : 1.02, the amount of sulphate of magnesia in 100 grains, —and which, as may be easily calculated, includes .71 of a grain of sulphuric acid.

To determine the proportions of acid, alumen, and manganese, 34.47 grains were dissolved in hot water, and nitrate of barytes being added in excess, the precipitate was collected, and well washed with distilled water upon a double filter. Dried at 212° the sulphate of barytes weighed 35.26 grains. Of these 31.13 were exposed to a low red heat, by which they were reduced to 29.71. Hence, as

31.13 : 29.71 :: 35.26 : 33.65, the true weight of the sulphate of barytes. And as

116.8 : 40.1 :: 33.65 : 11.55, the corresponding sulphuric acid. And as

34.47 : 11.55 :: 100 : 33.50, the sulphuric acid in 100 grains of the mineral.

To the washings of the sulphate of barytes, sulphuric acid was added, so as to precipitate the excess of the barytes, and this being separated by a single filter, ammonia was first added in excess, and then a current of sulphuretted hydrogen directed into the solution, by which operations the alumen was thrown down, and the manganese also, partly as oxide, and partly as sulphuret. The mixed precipitate was well washed upon a single filter, and then transferred to a porcelain capsule, where it was digested with caustic potash, with the view of

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dissolving the alumina. In the prosecution, however, of the analysis, I became convinced that this method of separation would not answer, for a trace of oxide of manganese was dissolved by the caustic potash, and however great the excess of alkali employed, and however long the digestion, a considerable quantity of alumen remained with the oxide.

To overcome this difficulty, a fresh portion of the mineral (30.4 grs.) was dissolved in water, and precipitated by the yellow ferrocyanide of potassium. The ferrocyanide of manganese thus thrown down, was collected on a single filter, and being well washed, was transferred to a porcelain capsule, in which it was digested with caustic potash. The oxide of manganese thus developed, when collected, washed, and dried, at 212° on a double filter, was found to weigh 4.21 grains. Of these 3.87 were reduced by a white heat to 2.21. Hence, as

3.87 : 2.21 :: 4.21 : 2.40 = red oxide of manganese, or that whose formula is $Mn_3 O_4$. And

38.36 : 35.7 :: 2.4 : 2.23, the equivalent quantity of protoxide of manganese. And

30.4 : 2.23 :: 100 : 7.33, the protoxide of manganese in 100 grains of the mineral.

The washings of the ferrocyanide of manganese were now supersaturated with sulphuric acid, and boiled with bicarbonate of soda added in excess, by which the alumen was precipitated. When washed and dried at 212° it weighed 5.89 grs. Of these 5.77 by a red heat were reduced to 3.18. Hence

5.77 : 3.18 :: 5.89 : 3.24 = true weight of alumen.

30.4 : 3.24 :: 100 : 10.65 = alumen in 100 grs. of the mineral.

The following, therefore, are the results of the analysis :—

Sulphuric acid	33.50—.71 = 32.79
Alumina	10.65
Protoxide of manganese	7.33
Sulphate of magnesia	1.08
Water of crystallization	48.15
	100.00

If these numbers be divided by the respective atomic weights, the following will be the quotients :

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	(1)	(2)	(3)
For Sulphuric acid . .	$\frac{32.79}{40.1}$	= .817	4
Alumina	$\frac{10.65}{25.7}$	= .414	2.026
Oxide of manganese .	$\frac{7.33}{35.7}$	= .205	1.003
Water	$\frac{48.15}{9}$	= 5.350	26.315

From a comparison of columns (2) and (3) the quotients will be seen to be almost exactly as the numbers 4, 2, 1, and 26, so that the mineral is composed of two atoms of the sesqui-sulphate of alumina, one atom of the sulphate of manganese, and twenty-six atoms of water. Its formula is therefore $3SO_3, Al_2O_3 + SO_3, MnO + 26\,HO$, or exactly conformable to that which belongs to soda alum.

It is well known that the neutral sulphate which enters as a proximate constituent into the composition of alum is not necessarily always the same. Chemists are long acquainted with the fact, that this sulphate may be one of potash, ammonia, or soda. More recently also it has been shown, that the alumina might be replaced indifferently by the sesqui-oxides of iron, chrome, and manganese, without disturbing the formula, or even the crystalline form of the salt, which in every instance is an octohedron. The species, however, whose examination has been just concluded, differs from all these in not containing any alkali, the place of this being occupied by the protoxide of manganese, and in not crystallizing in the octohedral form. I have attempted to crystallize it by evaporation in the presence of oil of vitriol in vacuo, but could only obtain a mass of a fibrous structure, closely resembling the mineral in its original state. I have also attempted unsuccessfully the synthetic production of this alum, by mixing sesqui-sulphate of alumina and sulphate of manganese in the proper proportions; the solution concentrated by evaporation, and then placed beneath the receiver of the air-pump with the oil of vitriol, could not be brought at all to the solid state. As this failure may be owing to the employment of too great an excess of sulphuric acid, I purpose repeating the experiment with all the necessary precautions, and with the addition of the one per cent. of sulphate of magnesia detected in the native product. This latter, indeed, can scarcely be considered as an essential component, as it in all probability merely replaces some sulphate

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of manganese; magnesia, and protoxide of manganese, being isomorphous substances. This hypothesis, it must be admitted, does not receive any support from the analytic results, as there is no deficiency of manganese; but the amount of the sulphate of magnesia is very small, and the discrepancy in question may well be due to errors of experiment.

As the alkali of alum may be replaced by the protoxide of manganese, and since, as Mitscherlich has shown, the alumina may be replaced by sesqui-oxide of manganese, it is obviously theoretically possible that an alum should exist containing no metal but manganese. I have not as yet had time to bring this anticipation to the test of experiment.

I shall conclude with one or two remarks, naturally suggested here, upon the important doctrines of isomorphism, first promulgated by Professor Mitscherlich of Berlin. These doctrines are generally considered as supported and well illustrated by the constitution and form of the different kinds of alum. This, however, would appear to be only partially true. Alumina, peroxide of iron, and the sesqui-oxides of manganese and chrome, having a similar composition, and being supposed (the two first certainly are so) isomorphous, we can understand how they might replace each other in alum without affecting its crystalline form. This is quite intelligible, and squares with the doctrines of Mitscherlich. But soda may, we know, be substituted for potash and ammonia, with neither of which it is isomorphous, and the octohedral form still subsist. Moreover, ammonia, potash, and soda alums contain—the two first twenty-four, the last twenty-six atoms of water, and nevertheless the crystal of each is a regular octohedron. These facts do not appear to be in accordance with the laws of isomorphism, as far as these have been hitherto developed, but I am far from thinking that they do not admit of explanation. The latter difficulty, for example, may be removed by supposing that the different varieties of alum have, as Professor Graham supposes, in reality the same quantity of combined water, and attributing the different proportions given by experiment to inevitable errors of manipulation, or to water mechanically interposed between the plates of the crystals.

In conclusion, I may observe, that upon the principles under consideration, the alum which I have described ought not to crystallize as an octohedron, inasmuch as the protoxide of manganese is not isomorphous with the alkalies.

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XII. *On a new Compound, consisting of Iodide of Potassium, Iodine, and the Essential Oil of Cinnamon.* By James Apjohn, M.D., M.R.I.A., *Professor of Chemistry in the Royal College of Surgeons, Ireland.*

Read 23rd April, 1838.

THE compound which is the subject of the present communication, owes its origin to an unchemical medical prescription. A solution of iodine and iodide of potassium in cinnamon water, having been directed by a physician of this city in the winter of 1837, his patient found that, during the prevalence of very cold weather, the solution, which had been previously turbid, became quite clear, and nearly insipid, and upon examining the bottle closely, he observed deposited in the bottom a small quantity of minute capillary crystals. These crystals were brought to Mr. Moore of Anne-street, the apothecary, in whose establishment the prescription was made up, and by him to me for chemical examination and analysis.

Before detailing the means which I have employed for determining the exact constitution of this substance, it will be proper to give the process by which it is best procured, and enumerate its leading properties; points, both of which were investigated by Mr. Moore and myself conjointly.

To a gallon of cinnamon water,* first reduced nearly to 32°, add four ounces of iodide of potassium and forty grains of iodine, previously dissolved in a minimum of cold water. Upon the instant of admixture the solution becomes quite turbid, owing to the production of a yellowish sediment, and this in less than a minute becomes crystalline, and then gradually subsides. The supernatant solution, which appears almost entirely deprived of iodine and oil of cinnamon, is now drawn off with a syphon, and the crystals and residual fluid thrown upon

* This water should be prepared by introducing into a still one pound of cassia bark and two gallons of water, and drawing off one gallon.

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a single filter, which, when sufficiently drained, is enveloped in several folds of blotting paper, and transferred to a chalk-stone, where by the absorbent powers of the latter, and the occurrence of spontaneous evaporation, the product is rendered perfectly dry and pure. With the quantities stated above sixty grains of the compound are obtained. A temperature at, or very close to 32° is necessary to the success of this process. At 40° the brown powder already noticed is alone produced, and in much diminished quantity. This brown sediment, however, is identical with the crystalline product, for it may be converted into crystals simply by reduction of its temperature; and I have even found it to undergo the same change when collected on a single filter, and set to dry on a bibulous stone at the temperature of 45°.

The crystals are capillary quadrilateral prisms, without pyramidal terminations. They are of a beautiful brown or bronze colour, and have a strong metallic lustre. Their taste is extremely hot and pungent, resembling closely that of oil of cassia, but partaking also of that of iodine. In alcohol and ether they are readily dissolved, and from these solvents they are again deposited with their original appearance upon the occurrence of spontaneous evaporation. They are decomposed by water, which extracts from them iodide of potassium, and causes the separation of oily drops of a dark colour, which are either a mechanical mixture, or a peculiar compound of iodine and the oil of cinnamon. This action of water, however, is greatly diminished when it is close to the freezing point, and appears altogether prevented when a certain amount of iodide of potassium is present.

When heated to 82° the crystals melt into a dark liquid, from which, upon cooling, the original substance is reproduced. When heated beyond its melting point, iodine and a vapour smelling strongly of oil of cinnamon, sublime, and iodide of potassium is left behind, mixed usually with a little carbon, resulting from the decomposition of a portion of the oil. Starch would appear to decompose this substance, for with even its alcoholic or ethereal solution it forms the well-known blue compound. When agitated with water, and zinc or iron filings, an iodide of these metals is produced, and the oil is set free. With mercury the result is the same, and in each instance for water, alcohol or ether may be substituted. Potash also at once developes the oil, forming, as in the case of free iodine, iodide of potassium, and iodate of potash.

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From these facts it seems legitimate to infer that it is the oil, and not any modification of it corresponding to the benzoyle of chemists, which is associated with the iodine and iodide of potassium, and that they are all held together by an extremely feeble affinity; inasmuch as not only is the iodide of potassium separated by water, as has been stated, but the iodine is affected by a solution of potash just as if it were free. To test the truth of this opinion, a little of the compound was decomposed in a small glass retort by the exact equivalent of a very dilute caustic alkali, and, a receiver being applied, about half an ounce of a liquid, having the appearance and obvious properties of cinnamon water, was drawn off by distillation. From it, however, I could not, though every precaution was employed, procure a particle of the original crystalline compound. The properties indeed of the distilled liquid were not, upon an accurate examination, identical with those of cinnamon water. Its odour, for example, was slightly different, and it reddened litmus,—a circumstance from which it may be inferred to contain cinnamic acid. It is therefore not unlikely that the oil may have absorbed oxygen, or have been otherwise altered, during the distillation; and as a confirmation of this opinion, I may mention that the oil of cassia which is found in the market abounds in cinnamic acid, and that a cinnamon water prepared from it by a process directed in some of the pharmacopœiæ yields but a very minute proportion of the substance which is the subject of the present paper.

With a view to the analysis of this compound, the first point to determine was the proportion of iodide of potassium which it included. To accomplish this, a known weight of it was heated in a small porcelain capsule, by which iodine and oil of cinnamon were expelled in the vaporous state, and there remained a mixture of iodide of potassium with a little carbon, resulting from the decomposition of a portion of the oil. The iodide of potassium was separated from the carbon by solution in water, and the use of a single filter, which had been previously deprived of all soluble matter by the action, first, of a dilute acid, and subsequently of distilled water. The filter being well washed, the solution was evaporated to dryness in a carefully counterpoised capsule, and then accurately weighed. The following are the results of three experiments thus conducted:

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	IK	IK
3.37 grains gave	0.43	12.75 per cent.
8.00 „	1.03	12.87 „
9.40 „	1.13	12.02 „

The mean therefore of the numbers in the third column, or 12.55,* is the quantity of iodide of potassium as obtained by me in 100 grains of the compound.

The next step was to investigate the iodine associated, not with the potassium, but with the oil, and to effect this the following was the course first pursued.

A known weight of the compound was decomposed by a slight excess of an alcoholic solution of potash, and the whole was evaporated to dryness, by which the oil was partly volatilized, and partly decomposed. Heat was now cautiously applied, so as to reduce the iodate, which I have already stated to be always formed in such experiment, to the state of iodide of potassium, but not to volatilize any of the latter salt. The residue, first permitted to cool, was treated with distilled water, and passed through a filter to separate the carbon. The filter was well washed, and the solution, having been reduced to a small bulk by evaporation, was precipitated by nitrate of silver, and the iodide of silver, first edulcorated three or four times with cold distilled water containing a few drops of ammonia, was finally dried, melted, and weighed.

In an experiment in which 10.33 grains of the compound were employed, the iodide of silver amounted to 7.41 grains, equivalent to 3.95 of iodine, or 38.24 for 100 grains of the compound. Now, if from this we subtract 9.58, the iodine in the 12.55 grains of iodide of potassium, which we have already found to exist in 100 of the compound, we will get for the per centage of iodine, in union with the oil, the number 28.66.

Fearing that the heat applied in reducing the iodate of potash to iodide of potassium, might have either been insufficient for the purpose, or have volatilized some of the latter salt, I recommenced the estimation of the amount of free iodine, or rather of that united to the oil, by a somewhat different process.

A known weight of the substance was introduced into a test tube with water and zinc filings, and the other end being drawn out at the spirit lamp, it was

* This contains 9.58 grains of iodine.

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hermetically sealed, so as effectually to prevent the volatilization of iodine. Agitation was now resorted to, and a gentle heat at the same time applied, which caused the separation of the oil, the iodine previously combined with it having entered into union with the zinc, and formed with it a salt dissolved by the water. The tube was now broken, and its contents having been thrown upon a single filter previously deprived of all soluble matter, distilled water was poured on until the entire of the iodide of zinc was carried through. The washings were concentrated, suffered to cool, and then treated with the equivalent quantity of nitrate of silver, and the resulting precipitate (iodide of silver) having been, as in the previous experiment, sparingly washed with cold water containing a little ammonia, was dried and weighed. From this the total quantity of iodine in the compound, both that combined with potassium and with the oil, was collected. But the quantity in the former state having been already ascertained, the difference is the iodine associated with the oil.

In an experiment thus conducted 6.55 grains of the substance yielded of iodide of silver 4.52 grains, equivalent to 37.20 grains of iodine for 100 of the compound. Subtracting from this 9.58, the iodine of the iodide of potassium, we obtain, as the representative of the amount of this element associated with the oil, the number 27.62. Hence

$$\frac{28.66+27.62}{2}=28.14$$

is the mean amount of the iodine in the latter state of combination as derivable from both experiments. But

$$\frac{28.14}{9.53}=2.93, \text{ or } q.\,p.=3.$$

We thus arrive at the conclusion, that for every atom of iodide of potassium in the substance under consideration there are three atoms of iodine in combination with the oil of cinnamon.

Before leaving this branch of the analysis I may observe, that the iodine of the oil may be directly obtained by decomposing the compound in a glass tube at a red heat in contact with lime, and acting upon the residue with water, which dissolves the iodide of calcium, and along with it a little lime. The latter being separated in the usual manner by carbonic acid and boiling, the former may be

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precipitated by oxalate of ammonia, and the iodine estimated from the amount of carbonate of lime afforded by the oxalate when calcined at an obscure red heat. An experiment made upon this plan did not give a very satisfactory result; and, when I considered the great disproportion between the atomic weights of iodine and of lime, I did not feel disposed to repeat the process.

The iodine may also be taken out of the compound by filings of iron, as well as those of zinc, in the form of iodide of this metal; and, though the theoretical objection just stated to the process by lime is equally applicable to this method, a single experiment, whose particulars I subjoin, thus conducted, led to a conclusion corresponding very closely with that already obtained.

Three grains of the compound gave 0.72 of peroxide of iron. But this amount of peroxide corresponds to 2.27 of iodine. Hence 8 : 2.27 : : 100 : 28.41, the per centage of iodine associated with the oil, and which exceeds the result, 28.14, obtained by the other methods, by a quantity so small, that it may be viewed as affording a corroboration of the correctness of the previous determination.

Having determined the iodide of potassium, and the iodine in union with the oil, we can now state the composition of the compound, assuming the residue to be oil of cinnamon.

Iodide of potassium	12.55
Iodine	28.14
Oil of cinnamon	59.30
	99.99

That it is the oil itself, and no oxidized or other modification of it, which exists in this compound, I have already assigned reasons for believing; and as, by the application of such heat as will fuse the compound, no water is set free, it becomes highly probable that the statement above made is a correct representation of its constitution. But the oil of cinnamon has been analyzed, and through the researches of Dumas we are acquainted with its real composition, which he has shown to be represented by the formula $C_{18} H_8 O_2$. If then the view numerically expressed above be the true one, the 59.30 parts of oil must correspond to some integer or at least simple number of atoms. And, reciprocally, if

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we find such to be the case, we shall be fortified in the conclusion which we have drawn.

With a view to this method of verification, let the numbers which represent the iodide of potassium and iodine, and that which is supposed to represent the oil, be divided by their respective atomic weights, and let the quotients be reduced to others in the same ratio, and so that the iodide of potassium may be represented by unity. When these arithmetical operations are performed, we obtain the numbers in the second and third columns of the following table, the former being the quotients themselves, and the latter other numbers bearing to each other the same proportion.

	(1)	(2)	(3)
Iodide of potassium . .	12.55	0.075	1.000
Iodine	28.14	0.223	2.973
Oil of cinnamon . . .	59.30	0.442	5.893

The numbers, it will be seen, in the last column approximate so clearly to the integers 1, 3, and 6, as to leave little doubt that the true empirical formula is

$$IK + I_3 + Cin_6.$$ *

A conclusion which is strikingly confirmed by the following statement of the composition of our substance in 100 parts, calculated upon this hypothesis:

Iodide of potassium	12.26
Iodine	28.08
Oil of cinnamon	59.66
	100.00

To apply, however, to this conclusion the most decisive test, it remained to burn the substance with oxide of copper, and see whether the carbonic acid and water thus obtained would correspond with the amount of oil of cinnamon ascribed to the compound.

7.08 grains (Liebig's apparatus for potash being employed) yielded of carbonic acid 12.70 grains, and of water 2.60,—equivalent to 3.513 carbon, and 0.233 hydrogen. But, adopting for a moment the empirical formula already

* *Cin* is assumed as the symbol for the oil of cinnamon.

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arrived at, the 7.08 grains of the substance would contain 4.223 of oil of cinnamon. If, therefore, from this we deduct the carbon and hydrogen, we obtain the oxygen, and find the constituents of the oil to be as follows:

Carbon	3.513
Hydrogen	0.288
Oxygen	0.420

If these be divided by the atomic weights, and that we substitute for the quotients numbers in the same ratio with them, that for carbon being assumed 18, we obtain the following:

Carbon	18.00
Hydrogen	8.82
Oxygen	1.60

As the conjoint result, therefore, of our analysis and our hypothesis, we find the formula for oil of cinnamon to be $C_{18}\ H_{8\cdot82}\ O_{1\cdot60}$. Now this is so close to the formula of Dumas, viz. $C_{18}\ H_8\ O_2$, particularly when we consider that owing to the fusibility of the compound, and the facility with which it is decomposed, heat could not be applied in drying the contents of the tube before the commencement of the combustion, and that consequently the hydrogen must have been too high, and the oxygen too low,—considering this, I say, the accordance is so close as to leave no doubt that the empirical formula already given correctly represents the constitution of the compound submitted to analysis. It is scarcely necessary to say that the most probable rational formula is that here subjoined.

$$IK + 3(I + Cin_2).$$

From the analysis which I first performed, and of which I gave a brief account in the Chemical Section at the Liverpool Meeting of the British Association for the Advancement of Science, the formula deduced was

$$IK + 2(I_2 + Cin_2),$$

which differs from the preceding merely in containing one more atom of iodine.

This compound appears interesting under many points of view. In the first place it is one of considerable complexity, is decomposed with an extreme facility, and is nevertheless perfectly definite in its composition, and even beautifully crystallized.

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In the second place it is a kind of double salt, composed of two haloid salts, in one of which the oil performs the very unusual function of an electro-positive or basic metal,—a circumstance the more singular, as Dumas has shown that it unites also to the muriatic and nitric acids, forming with them binary compounds, the latter of which very readily crystallizes. The oil in fact thus appears to act the part of a metal, as well as of an oxide.

Lastly, I may observe that the method by which our compound was first accidentally formed, and is still best made, presents an instance of incompatibility which had not been previously suspected, and will no doubt suggest to chemists experiments which will eventuate in the production of a series of similar substances. In reference, however, to this latter point, I should add, that Mr. Moore has applied to the other aromatic waters the very process which succeeds with cinnamon water, but without obtaining a trace of any new product. It is possible, however, that new results might be obtained by substituting other metals for the potassium, and replacing the iodine by bromine, or even chlorine; and I have indeed myself commenced some experiments with a view to this research.

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$$x = b^{\prime\prime\prime} = f^{\prime\prime\prime}(a_1^{\prime\prime\prime}, a_1^{\prime\prime}, a_1^{\prime\prime}, a_1^{\prime}, a_1, a_2, a_3, a_4)$$

$$= -\frac{a_1}{4} + a_1^{\prime\prime\prime} + a_1^{\prime\prime\prime};$$

the radical $a_1^{\prime\prime\prime}$ being defined by the equation

$$a_1^{\prime\prime\prime 2} = f_1^{\prime\prime}(a_1^{\prime\prime}, a_1^{\prime\prime}, a_1^{\prime}, a_1, a_2, a_3, a_4)$$

$$= -a_1^{\prime\prime 2} + 3e_3 + \frac{2e_4}{a_1^{\prime\prime}},$$

while $a_1^{\prime\prime}$, $a_1^{\prime\prime}$, $a_1^{\prime}$, and e_4, e_3, e_2, e_1, retain their recent meanings. Insomuch that either the function of third order $b^{\prime\prime}$, or the function of fourth order $b^{\prime\prime\prime}$, may be substituted for x in the general biquadratic equation; or, to express the same thing otherwise, the two equations following:

$$b^{\prime\prime 4} + a_1 b^{\prime\prime 3} + a_2 b^{\prime\prime 2} + a_3 b^{\prime\prime} + a_4 = 0,$$

and

$$b^{\prime\prime\prime 4} + a_1 b^{\prime\prime\prime 3} + a_2 b^{\prime\prime\prime 2} + a_3 b^{\prime\prime\prime} + a_4 = 0,$$

are both identically true, in virtue merely of the forms of the irrational functions $b^{\prime\prime}$ and $b^{\prime\prime\prime}$, and independently of the values of the four arbitrary coefficients a_1, a_2, a_3, a_4.

But for higher values of n the question becomes more difficult; and even for the case $n = 5$, that is, for the general equation of the fifth degree,

$$x^5 + a_1 x^4 + a_2 x^3 + a_3 x^2 + a_4 x + a_5 = 0,$$

the opinions of mathematicians appear to be not yet entirely agreed respecting the possibility or impossibility of expressing a root as a function of the coefficients by any finite combination of radicals and rational functions: or, in other words, respecting the possibility or impossibility of satisfying, by any irrational function $b^{(m)}$ of any finite order, the equation

$$b^{(m)5} + a_1 b^{(m)4} + a_2 b^{(m)3} + a_3 b^{(m)2} + a_4 b^{(m)} + a_5 = 0,$$

the five coefficients a_1, a_2, a_3, a_4, a_5, remaining altogether arbitrary. To assist in deciding opinions upon this important question, by developing and illustrating (with alterations) the admirable argument of ABEL against the possibility of any such expression for a root of the general equation of the fifth, or any higher

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degree; and by applying the principles of the same argument, to show that no expression of the same kind exists for any root of any general but lower equation, (quadratic, cubic, or biquadratic,) essentially distinct from those which have long been known; is the chief object of the present paper.

[3.] In general, if we call an irrational function *irreducible*, when it is impossible to express that function, or any one of its component radicals, by any smaller number of extractions of prime roots of variables, than the number which the actual expression of that function or radical involves; even by introducing roots of constant quantities, or of numerical equations, which roots are in this whole discussion considered as being themselves constant quantities, so that they neither influence the order of an irrational function, nor are included among the radicals denoted by the symbols a_1', &c.; then it is not difficult to prove that such *irreducible irrational functions* possess several properties in common, which are adapted to assist in deciding the question just now stated.

In the first place it may be observed, that, by an easy preparation, the general irrational function $b^{(m)}$ of any order m may be put under the form

$$b^{(m)} = \sum_{\beta_i^{(m)} < a_i^{(m)}} \cdot \left(b^{(m-1)}_{\beta_1^{(m)}, \ldots \beta_{n^{(m)}}^{(m)}} \cdot a_1^{(m)\beta_1^{(m)}} \ldots a_{n^{(m)}}^{(m)\beta_{n^{(m)}}^{(m)}} \right),$$

in which the coefficient $b^{(m-1)}_{\beta_1^{(m)}, \ldots \beta_{n^{(m)}}^{(m)}}$ is a function of the order $m-1$, or of a lower order; the exponent $\beta_i^{(m)}$ is zero, or any positive integer less than the prime number $a_i^{(m)}$ which enters as exponent into the equation of definition of the radical $a_i^{(m)}$, namely,

$$a_i^{(m)\, a_i^{(m)}} = f_i^{(m-1)};$$

and the sign of summation extends to all the $a_1^{(m)} \cdot a_2^{(m)} \ldots a_n^{(m)}$ terms which have exponents $\beta_i^{(m)}$ subject to the condition just now mentioned.

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For, inasmuch as $b^{(m)}$ is, by supposition, a rational function $f^{(m)}$ of all the radicals $a_i^{(k)}$, it is, with respect to any radical of highest order, such as $a_i^{(m)}$, a function of the form

$$b^{(m)} = \frac{\mathrm{N}\left(a_i^{(m)}\right)}{\mathrm{M}\left(a_i^{(m)}\right)},$$

M and N being here used as signs of some *whole* functions, or finite integral polynomes. Now, if we denote by ρ_α any root of the numerical equation

$$\rho_\alpha^{\alpha-1} + \rho_\alpha^{\alpha-2} + \rho_\alpha^{\alpha-3} + \ldots + \rho_\alpha^2 + \rho_\alpha + 1 = 0,$$

so that ρ_α is at the same time a root of unity, because the last equation gives

$$\rho_\alpha^\alpha = 1;$$

and if we suppose the number α to be prime, so that

$$\rho_\alpha, \rho_\alpha^2, \rho_\alpha^3, \ldots \rho_\alpha^{\alpha-1}$$

are, in some arrangement or other, the $\alpha - 1$ roots of the equation above assigned: then, the product of all the $\alpha - 1$ whole functions following,

$$\mathrm{M}\left(\rho_\alpha a\right) \cdot \mathrm{M}\left(\rho_\alpha^2 a\right) \ldots \mathrm{M}\left(\rho_\alpha^{\alpha-1} a\right) = \mathrm{L}(a),$$

is not only itself a whole function of a, but it is one which, when multiplied by $\mathrm{M}(a)$, gives a product of the form

$$\mathrm{L}(a) \cdot \mathrm{M}(a) = \mathrm{K}(a^\alpha),$$

K being here (as well as L) a sign of some whole function. If then we form the product

$$\mathrm{M}\left(\rho_{a_i^{(m)}} a_i^{(m)}\right) \cdot \mathrm{M}\left(\rho^2_{a_i^{(m)}} a_i^{(m)}\right) \ldots \mathrm{M}\left(\rho^{a_i^{(m)}-1}_{a_i^{(m)}} a_i^{(m)}\right) = \mathrm{L}\left(a_i^{(m)}\right),$$

and multiply, by it, both numerator and denominator of the recently assigned expression for $b^{(m)}$, we obtain this new expression for that general irrational function,

$$b^{(m)} = \frac{\mathrm{L}\left(a_i^{(m)}\right) \cdot \mathrm{N}\left(a_i^{(m)}\right)}{\mathrm{L}\left(a_i^{(m)}\right) \cdot \mathrm{M}\left(a_i^{(m)}\right)} = \frac{\mathrm{L}\left(a_i^{(m)}\right) \cdot \mathrm{N}\left(a_i^{(m)}\right)}{\mathrm{K}\left(a_i^{(m)} a_i^{(m)}\right)}$$

$$= \frac{\mathrm{L}\left(a_i^{(m)}\right) \cdot \mathrm{N}\left(a_i^{(m)}\right)}{\mathrm{K}\left(f_i^{(m-1)}\right)} = \mathrm{I}\left(a_i^{(m)}\right);$$

the characteristic I denoting here some function, which, relatively to the radical $a_i^{(m)}$, is whole, so that it may be thus developed,

$$b^{(m)} = \mathrm{I}\left(a_i^{(m)}\right) = \mathrm{I}_0 + \mathrm{I}_1 a_i^{(m)} + \mathrm{I}_2 a_i^{(m)2} + \ldots + \mathrm{I}_r a_i^{(m)r},$$

r being a finite positive integer, and the coefficients $\mathrm{I}_0, \mathrm{I}_1, \ldots \mathrm{I}_r$ being, in general, functions of the mth order, but not involving the radical $a_i^{(m)}$. And because the definition of that radical gives

$$a_i^{(m)h} = a_i^{(m)g} \cdot \left(f_i^{(m-1)}\right)^e,$$

if

$$h = g + e\, a_i^{(m)},$$

it is unnecessary to retain in evidence any of its powers of which the exponents are not less than $a_i^{(m)}$; we may therefore put the development of $b^{(m)}$ under the form

$$b^{(m)} = \mathrm{H}_0 + \mathrm{H}_1 a_i^{(m)} + \ldots + \mathrm{H}_{a_i^{(m)}-1}\left(a_i^{(m)}\right)^{a_i^{(m)}-1},$$

the coefficients $\mathrm{H}_0, \mathrm{H}_1, \ldots$ being still, in general, functions of the mth order, not involving the radical $a_i^{(m)}$. It is clear that by a repetition of this process of

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transformation, the radicals $a_1^{(m)}, \ldots . a_{n^{(m)}}^{(m)}$ may all be removed from the denominator of the rational function $f^{(m)}$; and that their exponents in the transformed numerator may all be depressed below the exponents which define those radicals: by which means, the development above announced for the general irrational function $b^{(m)}$ may be obtained; wherein the coefficient $b^{(m-1)}_{\beta_1^{(m)}, \ldots \beta_n^{(m)}}$ admits of being analogously developed.

For example, the function of the second order,

$$b'' = -\frac{a_1}{3} + a_1'' + \frac{c_2}{a_1''^2},$$

which was above assigned as an expression for a root of the general cubic equation, may be developed thus:

$$b'' = \sum_{\beta_1'' < 3} . \left(b'_{\beta_1''} . a_1''^{\beta_1''} \right) = b_0' + b_1' a_1'' + b_2' a_1''^2;$$

in which

$$b_0' = -\frac{a_1}{3},\ b_1' = 1,\ b_2' = \frac{c_2}{a_1'^3} = \frac{c_2}{f_1'} = \frac{c_2}{c_1 + a_1'}.$$

And this last coefficient b_2', which is itself a function of the first order, may be developed thus:

$$b_2' = \frac{c_2}{c_1 + a_1'} = \mathrm{B}' = \sum_{\beta_1' < 2} . \left(\mathrm{B}_{\beta_1'} . a_1'^{\beta_1'} \right) = \mathrm{B}_0 + \mathrm{B}_1 a_1';$$

in which

$$\mathrm{B}_0 = \frac{c_2 c_1}{c_1^2 - a_1'^2} = \frac{c_2 c_1}{c_1^2 - f_1'} = \frac{c_2 c_1}{c_2^2} = \frac{c_1}{c_2^2},$$

$$\mathrm{B}_1 = \frac{-1}{c_2^2}.$$

Again, the function of the third order,

$$b''' = \frac{-a_1}{4} + a_1''' + a_2''' + \frac{c_4}{a_1'''^3 a_2'''^2},$$

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which expresses a root of the general biquadratic equation, may be developed as follows:

$$b''' = \sum_{\substack{\beta_1''' < 2 \\ \beta_2''' < 2}} \cdot \left(b''_{\beta_1''', \beta_2'''} \cdot a_1'''^{\beta_1'''} \cdot a_2'''^{\beta_2'''} \right)$$

$$= b''_{,0} + b''_{,0}\, a_1''' + b''_{,1}\, a_2''' + b''_{,1}\, a_1''' a_2''';$$

in which

$$b''_{,0} = \frac{-a_1}{4},\ b''_{,0} = 1,\ b''_{,1} = 1,$$

and

$$b''_{,1} = \frac{e_4}{a_1''^{m_2} \cdot a_2''^{m_2}} = \frac{e_4}{f_1'' f_2''} = \frac{e_4}{\left(e_3 + a_1'' + \frac{e_2}{a_1''}\right)\left(e_3 + \rho_3 a_1'' + \frac{e_2}{\rho_3 a_1''}\right)}$$

$$= \frac{1}{e_4}\left(e_3 + \rho_3^2 a_1'' + \frac{e_2}{\rho_3^2 a_1''}\right).$$

And this last coefficient $b''_{,1}$, which is itself a function of the second order, may be developed thus:

$$b''_{,1} = \mathrm{B}'' = \sum_{\beta_1'' < 2} \cdot \left(\mathrm{B}'_{\beta_1''} \cdot a_1''^{\beta_1''} \right) = \mathrm{B}_0' + \mathrm{B}_1' a_1'' + \mathrm{B}_2' a_1''^2;$$

in which

$$\mathrm{B}_0' = \frac{e_3}{e_4},\ \mathrm{B}_1' = \frac{\rho_3^2}{e_4},\ \mathrm{B}_2' = \frac{\rho_3 e_2}{e_4 a_1''^3} = \frac{\rho_3 e_2}{e_4(e_1 + a_1')} = \frac{\rho_3(e_1 - a_1')}{e_4 e_2^2}.$$

So that, upon the whole, these functions b'' and b''', which express, respectively, roots of the general cubic and biquadratic equations, may be put under the following forms, which involve no radicals in denominators:

$$b'' = \frac{-a_1}{3} + a_1'' + (c_1 - a_1')\left(\frac{a_1''}{c_2}\right)^2,$$

and

$$b''' = \frac{-a_1}{4} + a_1''' + a_2'''$$

$$+ \frac{1}{e_4}\left\{e_3 + \rho_3^2 a_1'' + \rho_3(e_1 - a_1')\left(\frac{a_1''}{e_2}\right)^2\right\} a_1''' a_2''';$$

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and the functions f_1'', f_2'', which enter into the equations of definition of the radicals a_1''', a_2''', namely into the equations

$$a_1'''^2 = f_1'', \; a_2'''^2 = f_2'',$$

may in like manner be expressed so as to involve no radicals in denominators, namely thus:

$$a_1'''^2 = e_3 + a_1'' + (e_1 - a_1') \left(\frac{a_1''}{e_2}\right)^2,$$

$$a_2'''^2 = e_3 + \rho_3 a_1'' + \rho_3^2 (e_1 - a_1') \left(\frac{a_1''}{e_2}\right)^2.$$

It would be easy to give other instances of the same sort of transformation, but it seems unnecessary to do so.

[4.] It is important in the next place to observe, that any term of the foregoing general development of the general irrational function $b^{(m)}$, may be isolated from the rest, and expressed separately, as follows. Let $b^{(m)}_{\gamma_1^{(m)}, \ldots \gamma_n^{(m)}}$ denote a new irrational function, which is formed from $b^{(m)}$ by changing every radical such as $a_i^{(m)}$ to a corresponding product such as $\rho^{\gamma_i^{(m)}}_{a_i^{(m)}} a_i^{(m)}$, in which $\rho_{a_i^{(m)}}$ is, as before, a root of unity; so that

$$b^{(m)}_{\gamma_1^{(m)}, \ldots \gamma_n^{(m)}} =$$

$$\sum_{\beta_i^{(m)} < a_i^{(m)}} \cdot \left(b^{(m-1)}_{\beta_1^{(m)}, \ldots \beta_n^{(m)}} \cdot \rho^{\beta_1^{(m)} \gamma_1^{(m)}}_{a_1^{(m)}} \cdots \rho^{\beta_n^{(m)} \gamma_n^{(m)}}_{a_n^{(m)}} \cdot a_1^{(m)\beta_1^{(m)}} \cdots a_n^{(m)\beta_n^{(m)}} \right);$$

and let any isolated term of the corresponding development of $b^{(m)}$ or $b^{(m)}_{0, \ldots 0}$ be denoted by the symbol

$$t^{(m)}_{\beta_1^{(m)}, \ldots \beta_n^{(m)}} = b^{(m-1)}_{\beta_1^{(m)}, \ldots \beta_n^{(m)}} \cdot a_1^{(m)\beta_1^{(m)}} \cdots a_n^{(m)\beta_n^{(m)}};$$

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we shall then have, as the announced expression for this isolated term, the following:

$$t^{(m)}_{\beta_1^{(m)},\dots\beta_{n^{(m)}}^{(m)}} = \frac{1}{\alpha_1^{(m)}\dots\alpha_{n^{(m)}}^{(m)}} \cdot \sum_{\gamma_i^{(m)} < \alpha_i^{(m)}} \cdot \left(b^{(m)}_{\gamma_1^{(m)},\dots\gamma_{n^{(m)}}^{(m)}} \cdot \rho^{-\beta_1^{(m)}\gamma_1^{(m)}}_{a_1^{(m)}} \dots \rho^{-\beta_{n^{(m)}}^{(m)}\gamma_{n^{(m)}}^{(m)}}_{\alpha_{n^{(m)}}^{(m)}} \right);$$

the sign of summation here extending to all those terms in which every index such as $\gamma_i^{(m)}$ is equal to zero or to some positive integer less than $\alpha_i^{(m)}$.

Thus, in the case of the function of second order b'', which represents, as we have seen, a root of the general cubic equation, if we wish to obtain an isolated expression for any term $t''_{\beta_1''}$ of its development already found, namely the development

$$b'' = \sum_{\beta_1'' < 3} \cdot \left(b'_{\beta_1''} \cdot a_1''^{\beta_1''} \right) = b_0' + b_1' a_1'' + b_2' a_1''^2 = t_0'' + t_1'' + t_2'',$$

we have only to introduce the function

$$b''_{\gamma_1''} = \sum_{\beta_1'' < 3} \cdot \left(b'_{\beta_1''} \cdot \rho_3^{\beta_1''\gamma_1''} \cdot a_1''^{\beta_1''} \right)$$
$$= b_0' + b_1' \rho_3^{\gamma_1''} a_1'' + b_1' \rho_3^{2\gamma_1''} a_1''^2,$$

and to employ the formula

$$t''_{\beta_1''} = b'_{\beta_1''} \cdot a_1''^{\beta_1''} = \tfrac{1}{3} \cdot \sum_{\gamma_1'' < 3} \cdot \left(b''_{\gamma_1''} \cdot \rho_3^{-\beta_1''\gamma_1''} \right)$$
$$= \tfrac{1}{3} \left(b_0'' + \rho_3^{-\beta_1''} b_1'' + \rho_3^{-2\beta_1''} b_2'' \right).$$

In particular,

$$t_0'' = b_0' = \tfrac{1}{3}(b_0'' + b_1'' + b_2''),$$
$$t_1'' = b_1' a_1'' = \tfrac{1}{3}(b_0'' + \rho_3^{-1} b_1'' + \rho_3^{-2} b_2''),$$
$$t_2'' = b_2' a_1''^2 = \tfrac{1}{3}(b_0'' + \rho_3^{-2} b_1'' + \rho_3^{-1} b_2'');$$

in which

$$b_0'' = b_0' + b_1' a_1'' + b_2' a_1''^2 \; (= b''),$$
$$b_1'' = b_0' + b_1' \rho_3 a_1'' + b_2' \rho_3^2 a_1''^2,$$
$$b_2'' = b_0' + b_1' \rho_3^2 a_1'' + b_2' \rho_3^4 a_1''^2,$$

and in which it is to be remembered that

$$\rho_3^2 + \rho_3 + 1 = 0, \text{ and therefore } \rho_3^3 = 1.$$

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Again, if we wish to isolate any term $t'''_{\beta_1''',\beta_2'''}$ of the development above assigned for the function of third order b''', which represents a root of the general biquadratic equation, we may employ the formula

$$t'''_{\beta_1''',\beta_2'''} = b''_{\beta_1''',\beta_2'''} \cdot a_1'''^{\beta_1'''} \cdot a_2'''^{\beta_2'''} = \tfrac{1}{2}\cdot\tfrac{1}{2} \cdot \sum_{\substack{\gamma_1''' < 2 \\ \gamma_2''' < 2}} \cdot \left(b'''_{\gamma_1''',\gamma_2'''} \cdot \rho_2^{-\beta_1'''\gamma_1'''} \cdot \rho_2^{-\beta_2'''\gamma_2'''} \right)$$

$$= \tfrac{1}{4}\left\{ b'''_{0,0} + (-1)^{-\beta_1'''} b'''_{1,0} + (-1)^{-\beta_2'''} b'''_{0,1} + (-1)^{-(\beta_1'''+\beta_2''')} b'''_{1,1} \right\};$$

in which we have introduced the function

$$b'''_{\gamma_1''',\gamma_2'''} = \sum_{\substack{\beta_1''' < 2 \\ \beta_2''' < 2}} \cdot \left(b''_{\beta_1''',\beta_2'''} \cdot \rho_2^{\beta_1'''\gamma_1'''} \cdot \rho_2^{\beta_2'''\gamma_1'''} \cdot a_1'''^{\beta_1'''} \cdot a_2'''^{\beta_2'''} \right)$$

$$= b''_{0,0} + (-1)^{\gamma_1'''} b''_{1,0}\, a_1''' + (-1)^{\gamma_2'''} b''_{0,1}\, a_2''' + (-1)^{\gamma_1'''+\gamma_2'''} b''_{1,1}\, a_1'''\, a_2''';$$

so that, in particular, we have the four expressions

$$t'''_{0,0} = b''_{0,0} = \tfrac{1}{4}(b'''_{0,0} + b'''_{1,0} + b'''_{0,1} + b'''_{1,1}),$$

$$t'''_{1,0} = b''_{1,0}\, a_1''' = \tfrac{1}{4}(b'''_{0,0} - b'''_{1,0} + b'''_{0,1} - b'''_{1,1}),$$

$$t'''_{0,1} = b''_{0,1}\, a_2''' = \tfrac{1}{4}(b'''_{0,0} + b'''_{1,0} - b'''_{0,1} - b'''_{1,1}),$$

$$t'''_{1,1} = b''_{1,1}\, a_1'''\, a_2''' = \tfrac{1}{4}(b'''_{0,0} - b'''_{1,0} - b'''_{0,1} + b'''_{1,1}),$$

in which

$$b'''_{0,0} = b''_{0,0} + b''_{1,0} a_1''' + b''_{0,1} a_2''' + b''_{1,1} a_1''' a_2''',$$

$$b'''_{1,0} = b''_{0,0} - b''_{1,0} a_1''' + b''_{0,1} a_2''' - b''_{1,1} a_1''' a_2''',$$

$$b'''_{0,1} = b''_{0,0} + b''_{1,0} a_1''' - b''_{0,1} a_2''' - b''_{1,1} a_1''' a_2''',$$

$$b'''_{1,1} = b''_{0,0} - b''_{1,0} a_1''' - b''_{0,1} a_2''' + b''_{1,1} a_1''' a_2'''.$$

In these examples, the truth of the results is obvious; and the general demonstration follows easily from the properties of the roots of unity.

[5.] We have hitherto made no use of the assumed *irreducibility* of the irrational function $b^{(m)}$. But taking now this property into account, we soon

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perceive that the component radicals $a_i^{(k)}$, which enter into the composition of this irreducible function, must not be subject to, nor even compatible with, any equations or equation of condition whatever, except only the equations of definition, which determine those radicals $a_i^{(k)}$, by determining their prime powers $a_i^{(k)\,a_i^{(k)}}$. For the existence or possibility of any such equation of condition in conjunction with those equations of definition, would enable us to express at least one of the above mentioned radicals as a rational function of others of the same system, and of orders not higher than its own, or even, perhaps, as a rational function of the original variables $a_1, \ldots a_n$, though multiplied in general by a root of a numerical equation; and therefore would enable us to diminish the number of extractions of prime roots of functions, which would be inconsistent with the irreducibility supposed.

In fact, if any such equation of condition, involving any radical or radicals of the order k, but none of any higher order, were compatible with the equations of definition; then, by some obvious preparations, such as bringing the equation of condition to the form of zero equated to some finite polynomial function of some radical $a_i^{(k)}$ of the kth order; and rejecting, by the methods of equal roots and of the greatest common measure, all factors of this polynome, except those which are unequal among themselves, and are included among the factors of that other polynome which is equated to zero in the corresponding form of the equation of definition of the radical $a_i^{(k)}$; we should find that this last equation of definition

$$a_i^{(k)\,a_i^{(k)}} - f_i^{(k-1)} = 0$$

must be divisible, either identically, or at least for some suitable system of values of the remaining radicals, by an equation of condition of the form

$$a_i^{(k)\,g} + G_1^{(k)}\, a_i^{(k)\,g-1} + \ldots + G_{g-1}^{(k)}\, a_i^{(k)} + G_g^{(k)} = 0;$$

g being less than $a_i^{(k)}$, and the coefficients $G_1^{(k)}, \ldots G_g^{(k)}$ being functions of or-

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ders not higher than k, and not involving the radical $a_i^{(k)}$. Now if we were to suppose that, for any system of values of the remaining radicals, the coefficients $G_1^{(k)}, \ldots$ should all be $= 0$, or indeed if even the last of those coefficients should thus vanish, we should then have a new equation of condition, namely the following:

$$f_i^{(k-1)} = 0,$$

which would be obliged to be compatible with the equations of definition of the remaining radicals, and would therefore either conduct at last, by a repetition of the same analysis, to a radical essentially vanishing, and consequently superfluous, among those which have been supposed to enter into the composition of the function $b^{(m)}$; or else would bring us back to the divisibility of an equation of definition by an equation of condition, of the form just now assigned, and with coefficients $G_1^{(k)}, \ldots G_g^{(k)}$ which would not all be $= 0$. But for this purpose it would be necessary that a relation, or system of relations, should exist, (or at least should be compatible with the remaining equations of definition,) of the form

$$G_{g-e}^{(k)} = \nu_e \, a_i^{(k)\,e},$$

e being less than $a_i^{(k)}$, and ν_e being different from zero, and being a root of a numerical equation; and because $a_i^{(k)}$ is prime, we could find integer numbers λ and μ, which would satisfy the condition

$$\lambda \, a_i^{(k)} - \mu e = 1;$$

so that, finally, we should have an expression for the radical $a_i^{(k)}$, as a rational function of others of the same system, and of orders not higher than its own, though multiplied in general (as was above announced) by a root of a numerical equation; namely the following expression:

$$a_i^{(k)} = \nu_e^{\mu} \, G_{g-e}^{(k)-\mu} \, f_i^{(k-1)\lambda}.$$

And if we should suppose this last equation to be not identically true, but only

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to hold good for some systems of values of the remaining radicals, of orders not higher than k, we should still obtain, at least, an equation of condition between those remaining radicals, by raising the expression just found for $a_i^{(k)}$ to the power $a_i^{(k)}$; namely, the following equation of condition,

$$f_i^{(k-1)} - \left(\nu_e^{\mu}\ \mathrm{G}_{g-e}^{(k)-\mu}\ f_i^{(k-1)\lambda}\right)^{a_i^{(k)}} = 0,$$

which might then be treated like the former, till at last an expression should be obtained, of the kind above announced, for at least one of the remaining radicals. In every case, therefore, we should be conducted to a diminution of the number of prime roots of variables in the expression of the function $b^{(m)}$, which consequently would not be irreducible.

For example, if an irrational function of the mth order contain any radical $a_i^{(m)}$ of the cubic form, its exponent $\alpha_i^{(m)}$ being $= 3$, and its equation of definition being of the form

$$a_i^{(m)3} = f_i^{(m-1)}\left(a_1^{(m-1)}, \ldots a_{n^{(m-1)}}^{(m-1)}, \ldots . a_1, \ldots a_n\right);$$

if also the other equations of definition permit us to suppose that this radical *may* be equal to some rational function of the rest, so that an equation of the form

$$a_i^{(m)} + \mathrm{G}_1^{(m)} = 0,$$

(in which the function $\mathrm{G}_1^{(m)}$ does not contain the radical $a_i^{(m)}$,) is *compatible* with the equation of definition

$$a_i^{(m)3} - f_i^{(m-1)} = 0;$$

then, from the forms of these two last mentioned equations, the latter must be *divisible* by the former, at least for some suitable system of values of the remaining radicals: and therefore the following relation, which does not involve the radical $a_i^{(m)}$, namely,

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$$f_i^{(m-1)} + G_1^{(m)3} = 0,$$

must be either identically true, in which case we may substitute for the radical $a_i^{(m)}$, in the proposed function of the mth order, the expression

$$a_i^{(m)} = -\sqrt[3]{1} \cdot G_1^{(m)};$$

or at least it must be true as an equation of condition between the remaining radicals, and liable as such to a similar treatment, conducting to an analogous result.

A more simple and specific example is supplied by the following function of the second order,

$$x = -\frac{a_1}{3} + \sqrt[3]{(c_1 + \sqrt{c_1^2 - c_2^3})} + \sqrt[3]{(c_1 - \sqrt{c_1^2 - c_2^3})},$$

which is not uncommonly proposed as an expression for a root x of the general cubic equation

$$x^3 + a_1 x^2 + a_2 x + a_3 = 0,$$

c_1 and c_2 being certain rational functions of a_1, a_2, a_3, which were assigned in a former article, and which are such that the cubic equation may be thus written:

$$\left(x + \frac{a_1}{3}\right)^3 - 3c_2\left(x + \frac{a_1}{3}\right) - 2c_1 = 0.$$

Putting this function of the second order under the form

$$x = -\frac{a_1}{3} + a_1'' + a_2'',$$

in which the radicals are defined as follows,

$$a_1''^3 = c_1 + a_1', \quad a_2''^3 = c_1 - a_1', \quad a_1'^2 = c_1^2 - c_2^3,$$

we easily perceive that it is *permitted* by these definitions to suppose that the radicals a_1'', a_2'' are connected so as to satisfy the following equation of condition,

$$a_1''\, a_2'' = c_2;$$

and even that this supposition *must* be made, in order to render the proposed

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function of the second order a root of the cubic equation. But the mere knowledge of the *compatibility* of the equation of condition

$$a_2''-\frac{c_2}{a_1''}=0$$

with the equation of definition

$$a_2''^3-(c_1-a_1')=0,$$

is sufficient to enable us to infer, from the forms of these two equations, that the latter is divisible by the former, at least for some suitable system of values of the remaining radicals a_1'' and a_1', consistent with their equations of definition; and therefore that the following relation

$$c_1-a_1'-\left(\frac{c_2}{a_1''}\right)^3=0,$$

and the expression

$$a_2''=\sqrt[3]{1}\,.\,\frac{c_2}{a_1''},$$

are at least consistent with those equations. In the present example, the relation thus arrived at is found to be identically true, and consequently the radicals a_1' and a_1'' remain independent of each other; but for the same reason, the radical a_2'' may be changed to the expression just now given; so that the proposed function of the second order,

$$x=\frac{-a_1}{3}+a_1''+a_2'',$$

may, by the mere *definitions* of its radicals, and even without attending to the cubic equation which it was designed to satisfy, be put under the form

$$x=\frac{-a_1}{3}+a_1''+\sqrt[3]{1}\,.\,\frac{c_2}{a_1''},$$

the number of prime roots of variables being depressed from three to two; and consequently that proposed function was not *irreducible* in the sense which has been already explained.

[6.] From the foregoing properties of irrational and irreducible functions, it follows easily that if any *one* value of any such function $b^{(m)}$, corresponding to

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any one system of values of the radicals on which it depends, be equal to any one root of any equation of the form

$$x^s + A_1 x^{s-1} + \ldots + A_{s-1} x + A_s = 0,$$

in which the coefficients $A_1, \ldots A_s$ are any rational functions of the n original quantities $a_1, \ldots a_n$; in such a manner that for some one system of values of the radicals $a_1^{(m)}$, &c., the equation

$$b^{(m)s} + A_1 b^{(m)s-1} + \ldots + A_s = 0$$

is satisfied: then the same equation must be satisfied, also, for *all* systems of values of those radicals, consistent with their equations of definition. It is an immediate consequence of this result, that all the values of the function which has already been denoted by the symbol $b^{(m)}_{\gamma_1^{(m)} \ldots \gamma_n^{(m)}}$ must represent roots of the same equation of the sth degree; and the same principles show that all these values of $b^{(m)}_{\gamma_1^{(m)}}$ must be *unequal* among themselves, and therefore must represent so many *different roots* x_1, $x_2, \ldots$ of the same equation $x^s + \&c. = 0$, if every index or exponent $\gamma_i^{(m)}$ be restricted, as before, to denote either zero or some positive integer number less than the corresponding exponent $a_i^{(m)}$: for if, with this restriction, any two of the values of $b^{(m)}_{\gamma_1^{(m)} \ldots}$ could be supposed equal, an equation of condition between the radicals $a_1^{(m)}$, &c. would arise, which would be inconsistent with the supposed irreducibility of the function $b^{(m)}$.

For example, having found that the cubic equation

$$x^3 + a_1 x^2 + a_2 x + a_3 = 0$$

is satisfied by the irrational and irreducible function b'' above assigned, we can infer that the same equation is satisfied by all the three values b_0'', b_1'', b_2'' of the function b''_{γ_1}; and that these three values must be all unequal among themselves,

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so that they must represent some three unequal roots x_1, x_2, x_3, and consequently all the three roots of the cubic equation proposed.

[7.] Combining the result of the last article with that which was before obtained respecting the isolating of a term of a development, we see that if any root x of any proposed equation, of any degree s, in which the s coefficients $A_1, \ldots A_s$ are still supposed to be rational functions of the n original quantities $a_1, \ldots a_n$, can be expressed as an irrational and irreducible function $b^{(m)}$ of those original quantities; and if that function $b^{(m)}$ be developed under the form above assigned; then every term $t^{(m)}_{\beta_1^{(m)}, \ldots}$ of this development may be expressed as a rational (and indeed linear) function of some or all the s roots $x_1, x_2, \ldots x_s$ of the same proposed equation.

For example, when we have found that a root x of the cubic equation

$$x^3 + a_1 x^2 + a_2 x + a_3 = 0$$

can be represented by the irrational and irreducible function already mentioned,

$$x = b'' = b_0' + b_1' a_1'' + b_2' a_1''^2 = t_0'' + t_1'' + t_2'',$$

(in which $b_1' = 1$,) we can express the separate terms of this last development as follows,

$$\begin{aligned} t_0'' &= b_0' = \tfrac{1}{3}(x_1 + x_2 + x_3), \\ t_1'' &= b_1' a_1'' = \tfrac{1}{3}(x_1 + \rho_3^{-1} x_2 + \rho_3^{-2} x_3), \\ t_2'' &= b_2' a_1''^2 = \tfrac{1}{3}(x_1 + \rho_3^{-2} x_2 + \rho_3^{-4} x_3); \end{aligned}$$

namely, by changing b_0'', b_1'', b_2'' to x_1, x_2, x_3 in the expressions found before for t_0'', t_1'', t_2''.

In like manner, when a root x of the biquadratic equation

$$x^4 + a_1 x^3 + a_2 x^2 + a_3 x + a_4 = 0$$

is represented by the irrational function

$$\begin{aligned} x = b''' &= b_{0,0}'' + b_{1,0}'' a_1''' + b_{0,1}'' a_2''' + b_{1,1}'' a_1''' a_2''' \\ &= t_{0,0}''' + t_{1,0}''' + t_{0,1}''' + t_{1,1}''', \end{aligned}$$

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in which $b_{1}''_{,0} = b_{0}''_{,1} = 1$, we easily derive, from results obtained before, (by merely changing $b_{0}'''_{,0}$, $b_{0}'''_{,1}$, $b_{1}'''_{,0}$, $b_{1}'''_{,1}$ to x_1, x_2, x_3, x_4,) the following expressions for the four separate terms of this development:

$$t_{0}'''_{,0} = b_{0}''_{,0} = \tfrac{1}{4}(x_1 + x_2 + x_3 + x_4),$$
$$t_{1}'''_{,0} = b_{1}''_{,0}\, a_{1}''' = \tfrac{1}{4}(x_1 + x_2 - x_3 - x_4),$$
$$t_{0}'''_{,1} = b_{0}''_{,1}\, a_{2}''' = \tfrac{1}{4}(x_1 - x_2 + x_3 - x_4),$$
$$t_{1}'''_{,1} = b_{1}''_{,1}\, a_{1}'''\, a_{2}''' = \tfrac{1}{4}(x_1 - x_2 - x_3 + x_4);$$

x_1, x_2, x_3, x_4 being some four unequal roots, and therefore all the four roots of the proposed biquadratic equation.

And when that equation has a root represented in this other way, which also has been already indicated, and in which $b_{1}''' = 1$,

$$x = b^{IV} = \frac{-a_1}{4} + a_{1}''' + a_{1}^{IV} = b_{0}''' + b_{1}'''\, a_{1}^{IV} = t_{0}^{IV} + t_{1}^{IV},$$

then each of the two terms of this last development may be separately expressed as follows,

$$t_{0}^{IV} = b_{0}''' = \tfrac{1}{2}(x_1 + x_2),$$
$$t_{1}^{IV} = b_{1}'''\, a_{1}^{IV} = \tfrac{1}{2}(x_1 - x_2),$$

x_1 and x_2 being some two unequal roots of the same biquadratic equation.

A still more simple example is supplied by the quadratic equation,

$$x^2 + a_1 x + a_2 = 0;$$

for when we represent a root x of this equation as follows,

$$x = b' = \frac{-a_1}{2} + a_{1}' = t_{0}' + t_{1}',$$

we have the following well-known expressions for the two terms t_{0}', t_{1}', as rational and linear functions of the roots x_1, x_2,

$$t_{0}' = \frac{-a_1}{2} = \tfrac{1}{2}(x_1 + x_2),$$
$$t_{1}' = a_{1}' = \tfrac{1}{2}(x_1 - x_2).$$

In these examples, the radicals of highest order, namely, a_{1}' in b', a_{1}'' in b'',

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a_1''' and a_2''' in b''', and a_1^{IV} in b^{IV}, have all had the coefficients of their first powers equal to unity; and consequently have been themselves expressed as rational (though unsymmetric) functions of the roots of that equation in x, which the function $b^{(m)}$ satisfies; namely,

$$\begin{aligned}
a_1' &= \tfrac{1}{2}(x_1 - x_2),\\
a_1'' &= \tfrac{1}{3}(x_1 + \rho_3^2 x_2 + \rho_3 x_3),\\
a_1''' &= \tfrac{1}{4}(x_1 + x_2 - x_3 - x_4),\\
a_2''' &= \tfrac{1}{4}(x_1 - x_2 + x_3 - x_4),\\
a_1^{IV} &= \tfrac{1}{2}(x_1 - x_2);
\end{aligned}$$

the first expression being connected with the general quadratic, the second with the general cubic, and the three last with the general biquadratic equation. We shall soon see that all these results are included in one more general.

[8.] To illustrate, by a preliminary example, the reasonings to which we are next to proceed, let it be supposed that any two of the terms $t^{(m)}_{\beta_1{}^{(m)},\ldots}$ are of the forms

$$t'_{2,1,3,4} = b'_{2,1,3,4}\, a_1''^2\, a_2''\, a_3''^3\, a_4''^4,$$

and

$$t'_{1,1,2,3} = b'_{1,1,2,3}\, a_1''\, a_2''\, a_3''^2\, a_4''^3,$$

in which the radicals are defined by equations such as the following

$$a_1''^3 = f_1',\ a_2''^3 = f_2',\ a_3''^5 = f_3',\ a_4''^5 = f_4',$$

their exponents α_1'', α_2'', α_3'', α_4'' being respectively equal to the numbers 3, 3, 5, 5. We shall then have, by raising the two terms t'' to suitable powers, and attending to the equations of definition, the following expressions:

$$t''^{10}_{2,1,3,4} = b'^{10}_{2,1,3,4} f_1'^6 f_2'^3 f_3'^6 f_4'^8 a_1''^2 a_2'';$$

$$t''^{10}_{1,1,2,3} = b'^{10}_{1,1,2,3} f_1'^3 f_2'^3 f_3'^4 f_4'^6 a_1'' a_2'';$$

$$t''^{6}_{2,1,3,4} = b'^{6}_{2,1,3,4} f_1'^4 f_2'^2 f_3'^3 f_4'^4 a_3''^3 a_4''^4;$$

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$$t''^{6}_{1,1,2,3} = b'^{6}_{1,1,2,3} f'^{2}_{1} f'^{2}_{2} f'^{2}_{3} f'^{3}_{4} a''^{2}_{3} a''^{3}_{4};$$

which give

$$\mathrm{T}_1'' = \mathrm{C}_1' a_1'', \quad \mathrm{T}_2'' = \mathrm{C}_2' a_2'', \quad \mathrm{T}_3'' = \mathrm{C}_3' a_3'', \quad \mathrm{T}_4'' = \mathrm{C}_4' a_4'',$$

if we put, for abridgment,

$$\mathrm{T}_1'' = t''^{10}_{2,1,3,4}\ t''^{-10}_{1,1,2,3}; \quad \mathrm{C}_1' = b'^{10}_{2,1,3,4}\ b'^{-10}_{1,1,2,3}\ f'^{3}_{1} f'^{2}_{3} f'^{2}_{4};$$

$$\mathrm{T}_2'' = t''^{-10}_{2,1,3,4}\ t''^{20}_{1,1,2,3}; \quad \mathrm{C}_2' = b'^{-10}_{2,1,3,4}\ b'^{20}_{1,1,2,3}\ f'^{3}_{2} f'^{2}_{3} f'^{4}_{4};$$

$$\mathrm{T}_3'' = t''^{18}_{2,1,3,4}\ t''^{-24}_{1,1,2,3}; \quad \mathrm{C}_3' = b'^{18}_{2,1,3,4}\ b'^{-24}_{1,1,2,3}\ f'^{4}_{1} f'^{-3}_{2} f'^{2}_{3};$$

$$\mathrm{T}_4'' = t''^{-12}_{2,1,3,4}\ t''^{18}_{1,1,2,3}; \quad \mathrm{C}_4' = b'^{-12}_{2,1,3,4}\ b'^{18}_{1,1,2,3}\ f'^{-3}_{1} f'^{2}_{2} f'^{2}_{4}.$$

And, with a little attention, it becomes clear that the same sort of process may be applied to the terms $t^{(m)}_{\beta_1^{(m)},\ldots}$ of the development of any irreducible function $b^{(m)}$; so that we have, in general, a system of relations, such as the following:

$$\mathrm{T}_1^{(m)} = \mathrm{C}_1^{(m-1)}\ a_1^{(m)}; \quad \ldots\ \mathrm{T}^{(m)}_{n^{(m)}} = \mathrm{C}^{(m-1)}_{n^{(m)}}\ a^{(m)}_{n^{(m)}};$$

in which $\mathrm{T}_i^{(m)}$ is the product of certain powers (with exponents positive, or negative, or null) of the various terms $t^{(m)}_{\beta_1^{(m)},\ldots}$; and the coefficient $\mathrm{C}_i^{(m-1)}$ is different from zero, but is of an order lower than m. For if any radical of the order m were supposed to be so inextricably connected, in every term, with one or more of the remaining radicals of the same highest order, that it could not be disentangled from them by a process of the foregoing kind; and that thus the foregoing *analysis* of the function $b^{(m)}$ should be unable to conduct to separate expressions for those radicals; it would then, reciprocally, have been unnecessary to calculate them separately, in effecting the *synthesis* of that function; which function, consequently, would not be irreducible. If, for example, the exponents $a_1^{(m)}$ and $a_2^{(m)}$, which enter into the equations of definition of the radicals $a_1^{(m)}$ and $a_2^{(m)}$, should both be $= 3$, so that those radicals should both be cube-roots of

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functions of lower orders; and if these two cube-roots should enter only by their product, so that no analysis of the foregoing kind could obtain them otherwise than in connexion, and under the form $c^{(m-1)}\, a_1^{(m)}\, a_2^{(m)}$; it would then have been sufficient, in effecting the synthesis of $b^{(m)}$, to have calculated only the cube-root of the product $a_1^{(m)3}\, a_2^{(m)3} = f_1^{(m-1)}\, f_2^{(m-1)} = f^{(m-1)}$, instead of calculating separately the cube-roots of its two factors, $a_1^{(m)3} = f_1^{(m-1)}$, and $a_2^{(m)3} = f_2^{(m-1)}$: the number of extractions of prime roots of variables might, therefore, have been diminished in the calculation of the function $b^{(m)}$, which would be inconsistent with the irreducibility of that function.

In the cases of the irreducible functions b', b'', b''', b^{IV}, which have been above assigned, as representing roots of the general quadratic, cubic, and biquadratic equations, the theorem of the present article is seen at once to hold good; because in these the radicals of highest order are themselves terms of the developments in question, the coefficients of their first powers being already equal to unity. Thus in the development of b', we have $a_1' = t_1'$; in b'', we have $a_1'' = t_1''$; in b''', we have $a_1''' = t_{1,0}'''$, and $a_2''' = t_{0,1}'''$; and in b^{IV}, we have $a_1^{IV} = t_1^{IV}$.

[9.] By raising to the proper powers the general expressions of the form

$$\mathrm{T}_i^{(m)} = \mathrm{C}_i^{(m-1)}\, a_i^{(m)},$$

we obtain a system of $n^{(m)}$ equations of this other form

$$\mathrm{T}_i^{(m)\, a_i^{(m)}} = \mathrm{C}_i^{(m-1) a_i^{(m)}}\, f_i^{(m-1)} = f_i^{(m-1)},$$

$f_i^{(m-1)}$ being some new irrational function, of an order lower than m; and by combining the same expressions with those which define the various terms $t^{(m)}_{\beta_i^{(m)},\ldots}$, the number of which terms we shall denote by the symbol $t^{(m)}$, we obtain another system of $t^{(m)}$ equations, of which the following is a type,

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$$\mathrm{U}^{(m-1)}_{\beta_1^{(m)},\ldots\beta_{n^{(m)}}^{(m)}} = b^{\backprime(m-1)}_{\beta_1^{(m)},\ldots\beta_{n^{(m)}}^{(m)}},$$

if we put, for abridgment,

$$\mathrm{U}^{(m-1)}_{\beta_1^{(m)},\ldots} = t^{(m)}_{\beta_1{}^{(m)},\ldots} \cdot \mathrm{T}_1^{(m)-\beta_1^{(m)}} \ldots \mathrm{T}_{n^{(m)}}^{(m)-\beta_{n^{(m)}}^{(m)}},$$

and

$$b^{\backprime(m-1)}_{\beta_1^{(m)},\ldots} = b^{(m-1)}_{\beta_1^{(m)},\ldots} \cdot \mathrm{C}_1^{(m-1)-\beta_1^{(m)}} \ldots \mathrm{C}_{n^{(m)}}^{(m-1)-\beta_{n^{(m)}}^{(m)}}.$$

In this manner we obtain in general $n^{(m)} + t^{(m)}$ equations, in each of which the product of certain powers, (with positive, negative, or null exponents,) of the $t^{(m)}$ terms of the development of the irrational function $b^{(m)}$, is equated to some other irrational function, $f^{\backprime(m-1)}$ or $b^{\backprime(m-1)}$, of an order lower than m. Indeed, it is to be observed, that since these various equations are obtained by an elimination of the $n^{(m)}$ radicals of highest order, between their $n^{(m)}$ equations of definition and the $t^{(m)}$ expressions for the $t^{(m)}$ terms of the development of $b^{(m)}$, they cannot be equivalent to more than $t^{(m)}$ distinct relations. But, among them, they must involve explicitly all the radicals of lower orders, which enter into the composition of the irreducible function $b^{(m)}$. For if any radical $a_i^{(k)}$, of order lower than m, were wanting in all the $n^{(m)} + t^{(m)}$ functions of the forms

$$f_i^{\backprime(m-1)} \text{ and } b^{\backprime(m-1)}_{\beta_i^{(m)},\ldots},$$

we might then employ instead of the old system of radicals $a_1^{(m)}, \ldots$ of the order m, a new and equally numerous system of radicals $a_1^{\backprime(m)}, \ldots$ according to the following type,

$$a_i^{\backprime(m)} = \mathrm{T}_i^{(m)} = \sqrt[a_i^{(m)}]{f_i^{\backprime(m-1)}};$$

and might then express all the $t^{(m)}$ terms of $b^{(m)}$, by means of these new radicals, according to the formula

$$t^{(n)}_{\beta_1^{(n)},\ldots} = b^{\prime(n-1)}_{\beta_1^{(n)},\ldots} \cdot a_1^{\prime(n)\beta_1^{(n)}} \ldots a_n^{\prime(n)\beta_n^{(n)}},$$

which would not involve the radical $a_i^{(k)}$; so that in this way the number of extractions of prime roots of variables might be diminished, which would be inconsistent with the irreducibility of $b^{(n)}$.

The results of the present article may be exemplified in the case of any one of the functions b', b'', b''', b^{IV}, which have already been considered. Thus, in the case of the function b'', which represents a root of the general cubic equation, we have

$$\mathrm{T}''_1 = t''_1,\ \mathrm{C}''_1 = 1, f'^{\prime}_1 = f'_1,\ b'^{\prime}_{\beta_1''} = b'_{\beta_1''},\ \mathrm{U}'_{\beta_1''} = t'_{\beta_1''} \cdot t_1''^{-\beta_1''},$$

and the $n^{(n)} + t^{(n)} = 1 + 3 = 4$ following relations hold good:

$$t_1''^3 = f_1',\ t_0'' = b_0',\ 1 = b_1',\ t_2''\, t_1''^{-2} = b_2';$$

of which indeed the third is identically true, and the second does not involve a_1', because $b_0' = -\frac{a_1}{3}$; but both the first and fourth of these relations involve that radical a_1', because $f_1' = c_1 + a_1'$, and $b_2' = \frac{c_1 - a_1'}{c_2^2}$.

[10.] Since each of the $t^{(n)}$ terms of the development of $b^{(n)}$ can be expressed as a rational function of the s roots $x_1, \ldots x_s$ of that equation of the sth degree which $b^{(n)}$ is supposed to satisfy; it follows that every rational function of these $t^{(n)}$ terms must be likewise a rational function of those s roots, and must admit, as such, of some finite number r of values, corresponding to all possible changes of arrangement of the same s roots among themselves. The same term or function must, for the same reason, be itself a root of an equation of the rth degree, of which the coefficients are symmetrical functions of the s roots, $x_1, \ldots x_s$, and therefore are rational functions of the s coefficient $\mathrm{A}_1, \ldots \mathrm{A}_s$, and ultimately of the n original quantities $a_1, \ldots a_n$; while the $r-1$ other roots of this new equation are the $r-1$ other values of the same function of $x_1, \ldots x_s$, corresponding to the changes of arrangement just now mentioned. Hence,

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every one of the $n^{(m)} + t^{(m)}$ functions $\mathrm{T}_i^{(m)\,a_i^{(m)}}$ and $\mathrm{U}_{\beta_1,\ldots}^{(m-1)}{}_{(m)}$, and therefore also every one of the $n^{(m)} + t^{(m)}$ functions $f_i^{(m-1)}$ and $b_{\beta_1,\ldots}^{(m-1)}{}_{(m)}$, to which they are respectively equal, and which have been shown to contain, among them, all the radicals of orders lower than m, must be a root of some such new equation, although the degree r will not in general be the same for all. Treating these new equations and functions, and the radicals of the order $m-1$, as the equation $x^r + \&c. = 0$, the function $b^{(m)}$, and the radicals of the order m have been already treated; we obtain a new system of relations, analogous to those already found, and capable of being thus denoted:

$$\mathrm{T}_i^{(m-1)} = \mathrm{C}_i^{(m-2)}\, a_i^{(m-1)};$$

$$\mathrm{T}_i^{(m-1)\,a_i^{(m-1)}} = f_i^{(m-2)};$$

$$\mathrm{U}_{\beta_1,\ldots}^{(m-1)}{}_{(m-1)} = b_{\beta_1,\ldots}^{(m-2)}{}_{(m-1)}.$$

And so proceeding, we come at last to a system of the form,

$$\mathrm{T}_1' = \mathrm{C}_1 a_1', \ldots \mathrm{T}_{n'}' = \mathrm{C}_{n'} a_{n'}';$$

in which the coefficient C_i is different from zero, and is a rational function of the n original quantities $a_1, \ldots a_n$; while T_i' is a rational function of the s roots $x_1, \ldots x_s$ of that equation of the sth degree in x which it has been supposed that $b^{(m)}$ satisfies. We have therefore the expression

$$a_i' = \frac{\mathrm{T}_i'}{\mathrm{C}_i};$$

which enables us to consider every radical a_i', of the first order, as a rational function F_i' of the s roots $x_1, \ldots x_s$, and of the n original quantities $a_1, \ldots a_n$: so that we may write

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$$a'_i = \mathrm{F}'_i(x_1, \ldots x_s, a_1, \ldots a_n).$$

But before arriving at the last mentioned system of relations, another system of the form

$$\mathrm{T}_1'' = \mathrm{C}_1' a_1^{\alpha}, \ldots \mathrm{T}''_{n''} = \mathrm{C}'_{n''} a^{\beta}_{n''}$$

must have been found, in which the coefficient c'_i is different from zero, and is a rational function of $a'_1, \ldots a'_{n'}$ and of $a_1, \ldots a_n$, while T''_i is a rational function of $x_1, \ldots x_s$; we have therefore the expression

$$a''_i = \frac{\mathrm{T}''_i}{\mathrm{C}'_i},$$

and we see that every radical of the second order also is equal to a rational function of $x_1, \ldots x_s$ and of $a_1, \ldots a_n$: so that we may write

$$a''_i = \mathrm{F}''_i(x_1, \ldots x_s, a_1, \ldots a_n).$$

And re-ascending thus, through orders higher and higher, we find, finally, by similar reasonings, that every one of the $n' + n'' + \ldots + n^{(k)} + \ldots + n^{(m)}$ radicals which enter into the composition of the irrational and irreducible function $b^{(m)}$, such as the radical $a^{(k)}_i$, must be expressible as a rational function $\mathrm{F}^{(k)}_i$ of the roots $x_1, \ldots x_s$, and of the original quantities $a_1, \ldots a_n$: so that we have a complete system of expressions, for all these radicals, which are included in the general formula

$$a^{(k)}_i = \mathrm{F}^{(k)}_i(x_1, \ldots x_s, a_1, \ldots a_n).$$

Thus, in the case of the cubic equation and the function b'', when we have arrived at the relation

$$t_1''^3 = f_1',$$

in which

$$t_1'' = \tfrac{1}{3}(x_1 + \rho_3^2 x_2 + \rho_3 x_3), \text{ and } f_1' = c_1 + a_1',$$

we find that the rational function

$$t_1''^3 = \tfrac{1}{27}(x_1 + \rho_3^2 x_2 + \rho_3 x_3)^3$$

admits only of *two* different values, in whatever way the arrangement of the three roots x_1, x_2, x_3 may be changed; it must therefore be itself a root of a quadratic equation, in which the coefficients are symmetric functions of those three roots, and consequently rational functions of a_1, a_2, a_3; namely, the equation

$$\begin{aligned} 0 &= (t_1''^3)^2 - \tfrac{1}{27}\{(x_1 + \rho_3^2 x_2 + \rho_3 x_3)^3 + (x_1 + \rho_3^2 x_3 + \rho_3 x_2)^3\}(t_1''^3) \\ &\quad + \tfrac{1}{729}(x_1 + \rho_3^2 x_2 + \rho_3 x_3)^3 (x_1 + \rho_3^2 x_3 + \rho_3 x_2)^3 \\ &= (t_1''^3)^2 + \tfrac{1}{27}(2a_1^3 - 9a_1 a_2 + 27a_3)(t_1''^3) + \left(\frac{a_1^2 - 3a_2}{9}\right)^3. \end{aligned}$$

The same quadratic equation must therefore be satisfied when we substitute for $t_1''^3$ the function $c_1 + a_1'$ to which it is equal, and in which a_1' is a square root; it must therefore be satisfied by *both* values of the function $c_1 \pm a_1'$, because the radical a_1' must be subject to no condition except that by which its square is determined; therefore, this radical a_1' must be equal to the semidifference of two unequal roots of the same quadratic equation; that is, to the semidifference of the two values of the rational function $t_1''^3$; which semi-difference *is itself a rational function of* x_1, x_2, x_3, namely,

$$\begin{aligned} a_1' &= \tfrac{1}{54}\{(x_1 + \rho_3^2 x_2 + \rho_3 x_3)^3 - (x_1 + \rho_3^2 x_3 + \rho_3 x_2)^3\} \\ &= \tfrac{1}{18}(\rho_3^2 - \rho_3)(x_1 - x_2)(x_1 - x_3)(x_2 - x_3) = r_1'(x_1, x_2, x_3). \end{aligned}$$

The same conclusion would have been obtained, though in a somewhat less simple way, if we had employed the relation

$$t_2''\, t_1''^{-2} = b_2',$$

in which

$$t_2''\, t_1''^{-2} = \frac{3(x_1 + \rho_3^2 x_3 + \rho_3 x_2)}{(x_1 + \rho_3^2 x_2 + \rho_3 x_3)^2}, \quad b_2' = \frac{c_1 - a_1'}{c_2^2}.$$

[11.] In general, let p be the number of values which the rational function $r_i^{(k)}$ can receive, by altering in all possible ways the arrangement of the s roots $x_1, \ldots x_s$, these roots being still treated as arbitrary and independent quantities,

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(so that p is equal either to the product $1.2.3 \ldots s$, or to some submultiple of that produet); we shall then have an *identical* equation of the form

$$\mathrm{F}_i^{(k)p} + \mathrm{D}_1 \mathrm{F}_i^{(k)p-1} + \ldots + \mathrm{D}_{p-1} \mathrm{F}_i^{(k)} + \mathrm{D}_p = 0,$$

in which the coefficients $\mathrm{D}_1, \ldots \mathrm{D}_p$ are rational functions of $a_1, \ldots a_n$; and therefore at least *one* value of the radical $a_i^{(k)}$ must satisfy the equation

$$a_i^{(k)p} + \mathrm{D}_1 a_i^{(k)p-1} + \ldots + \mathrm{D}_{p-1} a_i^{(k)} + \mathrm{D}_p = 0.$$

But in order to this, it is necessary, for reasons already explained, that *all* the values of the same radical $a_i^{(k)}$, obtained by multiplying itself and all its subordinate radicals of the same functional system by any powers of the corresponding roots of unity, should satisfy the same equation; and therefore that the number q of these values of the radical $a_i^{(k)}$ should *not exceed* the degree p of that equation, or the number of the values of the rational function $\mathrm{F}_i^{(k)}$.

Again, since we have denoted by q the number of values of the radical, we must suppose that it satisfies identically an equation of the form

$$a_i^{(k)q} + \mathrm{E}_1 a^{(k)q-1} + \ldots + \mathrm{E}_{q-1} a_i^{(k)} + \mathrm{E}_q = 0,$$

the coefficients $\mathrm{E}_1, \ldots \mathrm{E}_q$ being rational functions of $a_1, \ldots a_n$; and therefore that at least one value of the function $\mathrm{F}_i^{(k)}$ satisfies the equation

$$\mathrm{F}_i^{(k)q} + \mathrm{E}_1 . \mathrm{F}_i^{(k)q-1} + \ldots + \mathrm{E}_{q-1} . \mathrm{F}_i^{(k)} + \mathrm{E}_q = 0.$$

Suppose now that the s roots $x_1, \ldots x_s$ of the original equation in x,

$$x^s + \mathrm{A}_1 x^{s-1} + \ldots + \mathrm{A}_{s-1}\, x + \mathrm{A}_s = 0,$$

are really unconnected by any relation among themselves, a supposition which requires that s should not be greater than n, since $\mathrm{A}_1, \ldots \mathrm{A}_s$ are rational functions of $a_1, \ldots a_n$; suppose also that $a_1, \ldots a_n$ can be expressed, reciprocally,

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as rational functions of $A_1, \ldots A_s$, a supposition which requires, reciprocally, that n should not be greater than s, because *the original quantities* $a_1, \ldots a_n$ *are, in this whole discussion, considered as independent of each other.* With these suppositions, which involve the equality $s = n$, we may consider the n quantities $a_1, \ldots a_n$, and therefore also the q coefficients $E_1, \ldots E_q$, as being symmetric functions of the n roots $x_1, \ldots x_n$ of the equation

$$x^n + A_1 x^{n-1} + \ldots + A_{n-1} x + A_n = 0;$$

we may also consider $F_i^{(k)}$ as being a rational but unsymmetric function of the same n arbitrary roots, so that we may write

$$a_i^{(k)} = F_i^{(k)}(x_1, \ldots x_n);$$

and since the truth of the equation

$$F_i^{(k)\,q} + E_1 F_i^{(k)\,q-1} + \ldots + E_q = 0$$

must depend only on the *forms of the functions*, and not on the *values of the quantities* which it involves, (those values being altogether arbitrary,) we may alter in any manner the arrangement of these n arbitrary quantities $x_1, \ldots x_n$, and the equation must still hold good. But by such changes of arrangement, the symmetric coefficients $E_1, \ldots E_q$ remain unchanged, while the rational but unsymmetric function $F_i^{(k)}$ takes, in succession, all those p values of which it was before supposed to be capable; these p unequal values therefore must all be roots of the same equation of the qth degree, and consequently q must *not be less* than p. And since it has been shown that the former of these two last mentioned numbers must *not exceed* the latter, it follows that they must be *equal* to each other, so that we have the relation

$$q = p:$$

that is, the radical $a_i^{(k)}$ and the rational function $F_i^{(k)}$ must be exactly *coextensive in multiplicity of value.*

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For example, when, in considering the irreducible irrational expression b'' for a root of the general cubic, we are conducted to the relation assigned in the last article,

$$a_1' = \mathrm{F}_1'(x_1, x_2, x_3) = \tfrac{1}{18}(\rho_3^2 - \rho_3)(x_1 - x_2)(x_1 - x_3)(x_2 - x_3);$$

we can then at pleasure infer, either that the radical a_1' must admit (as a radical) of two and only two values, if we have previously perceived that the rational function F_1' admits (as a rational function) of two values, and only two, corresponding to changes of arrangement of the three roots x_1, x_2, x_3, namely, the two following values, which differ by their signs,

$$\pm \tfrac{1}{18}(\rho^2 - \rho_3)(x_1 - x_2)(x_1 - x_3)(x_2 - x_3);$$

or else we may infer that the function F_1' admits thus of two values and two only, for all changes of arrangement of x_1, x_2, x_3, if we have perceived that the radical a_1' (as being given by its square,

$$a_1'^2 = f_1 = c_1^2 - c_2^3,$$

which square is rational,) admits, itself, of the two values $\pm a_1'$ which differ in their signs.

[12.] The conditions assumed in the last article are all fulfilled, when we suppose the coefficients A_1 &c. to coincide with the n original quantities a_1, &c., that is, when we return to the equation originally proposed;

$$x^n + a_1 x^{n-1} + \ldots + a_{n-1} x + a_n = 0,$$

which is the general equation of the nth degree: so that we have, for any radical $a_i^{(k)}$, which enters into the composition of any irrational and irreducible function representing any root of any such equation, an expression of the form

$$a_i^{(k)} = \mathrm{F}_i^{(k)}(x_1, \ldots x_n);$$

the radical and the rational function being coextensive in multiplicity of value. We are, therefore, conducted thus to the following important theorem, to which Abel first was led, by reasonings somewhat different from the foregoing:

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namely, that "if a root x of the general equation of any particular degree n can be expressed as an irreducible irrational function $b^{(m)}$ of the n arbitrary coefficients of that equation, then every radical $a_i^{(k)}$, which enters into the composition of that function $b^{(m)}$, must admit of being expressed as a rational, though unsymmetric function $\mathrm{F}_i^{(k)}$ of the n arbitrary roots of the same general equation; and this rational but unsymmetric funtion $\mathrm{F}_i^{(k)}$ must admit of receiving exactly the same variety of values, through changes of arrangement of the n roots on which it depends, as that which the radical $a_i^{(k)}$ can receive, through multiplications of itself and of all its subordinate functional radicals by any powers of the corresponding roots of unity."

Examples of the truth of this theorem have already been given, by anticipation, in the seventh and tenth articles of this Essay; to which we may add, that the radicals a_1'' and a_1', in the expressions given above for a root of the general biquadratic, admit of being thus expressed:

$$\begin{aligned} a_1'' &= \tfrac{1}{4^3}\{(x_1+x_2-x_3-x_4)^2+\rho_3^2(x_1-x_2+x_3-x_4)^2+\rho_3(x_1-x_2-x_3+x_4)^2\} \\ &= \tfrac{1}{12}\{x_1x_2+x_3x_4+\rho_3^2(x_1x_3+x_2x_4)+\rho_3(x_1x_4+x_2x_3)\}; \\ a_1' &= \tfrac{1}{3456}\{x_1x_2+x_3x_4+\rho_3^2(x_1x_3+x_2x_4)+\rho_3(x_1x_4+x_2x_3)\}^3 \\ &\quad -\tfrac{1}{3456}\{x_1x_2+x_3x_4+\rho_3^2(x_1x_4+x_2x_3)+\rho_3(x_1x_3+x_2x_4)\}^3 \\ &= \tfrac{1}{1152}(\rho_3^2-\rho_3)(x_1-x_2)(x_1-x_3)(x_1-x_4)(x_2-x_3)(x_2-x_4)(x_3-x_4). \end{aligned}$$

But before we proceed to apply this theorem to prove, in a manner similar to that of Abel, the impossibility of obtaining any finite expression, irrational and irreducible, for a root of the general equation of the fifth degree, it will be instructive to apply it, in a new way, (according to the announcement made in the second article,) to equations of lower degrees; so as to draw, from those lower equations, a class of illustrations quite different from those which have been heretofore adduced: namely, by showing, *à priori*, with the help of the same general theorem, that no new finite function, irrational and irreducible, can be found, essentially distinct in its radicals from those which have long since been

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discovered, for expressing any root of any such lower but general equation, quadratic, cubic, or biquadratic, in terms of the coefficients of that equation.

[13.] Beginning then with the general quadratic,

$$x^2 + a_1 x + a_2 = 0,$$

let us endeavour to investigate, *à priori*, with the help of the foregoing theorem, all possible forms of irrational and irreducible functions $b^{(m)}$, which can express a root x of this quadratic, in terms of the two arbitrary coefficients a_1, a_2, so as to satisfy identically, or independently of the values of those two coefficients, the equation

$$b^{(m)^2} + a_1 b^{(m)} + a_2 = 0.$$

The two roots of the proposed quadratic being denoted by the symbols x_1 and x_2, we know that the two coefficients a_1 and a_2 are equal to the following symmetric functions,

$$a_1 = -(x_1 + x_2), \quad a_2 = x_1 x_2;$$

we cannot therefore suppose either root to be a rational function b of these coefficients, because an unsymmetric function of two arbitrary quantities cannot be equal to a symmetric function of the same; and consequently we must suppose that the exponent m of the order of the sought function $b^{(m)}$ is greater than 0. The expression $b^{(m)}$ for x must therefore involve at least one radical a_1', which must itself admit of being expressed as a rational but unsymmetric function of the two roots x_1, x_2,

$$a_1' = \mathrm{F}_1'(x_1, x_2),$$

and of which some prime power can be expressed as a rational function of the two coefficients a_1, a_2,

$$a_1'^{a_1'} = f(a_1, a_2),$$

the exponent a_1' being equal to the number of the values

$$\mathrm{F}_1'(x_1, x_2), \quad \mathrm{F}_1'(x_2, x_1),$$

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of the unsymmetric function F_1', and consequently being $= 2$; so that the radical a_1' must be a square root, and must have two values differing in sign, which may be thus expressed:

$$+a_1' = \mathrm{F}_1'(x_1, x_2), \quad -a_1' = \mathrm{F}_1'(x_2, x_1).$$

But, in general, whatever rational function may be denoted by F, the quotients

$$\frac{\mathrm{F}(x_1, x_2) + \mathrm{F}(x_2, x_1)}{2} \quad \text{and} \quad \frac{\mathrm{F}(x_1, x_2) - \mathrm{F}(x_2, x_1)}{2(x_1 - x_2)}$$

are some symmetric functions, a and b; so that we may put generally

$$\mathrm{F}(x_1, x_2) = a + b(x_1 - x_2),$$
$$\mathrm{F}(x_2, x_1) = a - b(x_1 - x_2);$$

therefore, since we have, at present,

$$\mathrm{F}_1'(x_2, x_1) = -\mathrm{F}_1'(x_1, x_2),$$

the function F_1' must be of the form

$$\mathrm{F}_1'(x_1, x_2) = b(x_1 - x_2),$$

the multiplier b being symmetric. At the same time,

$$a_1' = b(x_1 - x_2),$$

and therefore the function f_1 is of the form

$$f_1(a_1, a_2) = a_1'^2 = b^2(x_1 - x_2)^2 = b^2(a_1^2 - 4a_2),$$

so that the radical a_1' may be thus expressed,

$$a_1' = \sqrt{b^2(a_1^2 - 4a_2)},$$

in which, b is some rational function of the coefficients a_1, a_2. No other radical a_2' of the first order can enter into the sought irreducible expression for x; because the same reasoning would show that any such new radical ought to be reducible to the form

$$a_2' = c(x_1 - x_2) = \frac{c}{b}a_1',$$

c being some new symmetric function of the roots, and consequently some new rational function of the coefficients; so that, after calculating the radical a_1', it

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would be unnecessary to effect any new extraction of prime roots for the purpose of calculating a_2', which latter radical would therefore be superfluous. Nor can any radical a_1'' of higher order enter, because such radical would have $2\,a_1''$ values, a_1'' being greater than 1, while any rational function F_1'', of two arbitrary quantities x_1, x_2, can receive only two values, through any changes of their arrangement. The exponent m, of the order of the sought irreducible function $b^{(m)}$, must therefore be = 1, and this function itself must be of the form

$$b' = b_0 + b_1 a_1',$$

b_0 and b_1 being rational functions of a_1, a_2, or symmetric functions of the two roots x_1, x_2, which roots must admit of being separately expressed as follows:

$$x_1 = b_0 + b_1 a_1', \quad x_2 = b_0 - b_1 a_1',$$

if any expression of the sought kind can be found for either of them. It is, therefore, necessary and sufficient for the existence of such an expression, that the two following quantities,

$$b_0 = \frac{x_1 + x_2}{2}, \quad b_1 = \frac{x_1 - x_2}{2\,a_1'},$$

should admit of being expressed as rational functions of a_1, a_2; and this condition is satisfied, since the foregoing relations give

$$b_0 = -\frac{a_1}{2}, \quad b_1 = \frac{1}{2b}.$$

We find, therefore, as the sought irrational and irreducible expression, and as the only possible expression of that kind, (or at least as one with which all others must essentially coincide,) for a root x of the general quadratic, the following:

$$x = b' = -\frac{a_1}{2} + \frac{1}{2b}\sqrt{b^2(a_1^2 - 4\,a_2)};$$

b still denoting any arbitrary rational function of the two arbitrary coefficients a_1, a_2, or any numerical constant, (such as the number 1, which was the value of this quantity b in the formulæ of the preceding articles,) and the two separate roots x_1, x_2, being obtained by taking separately the two signs of the radical. And thus we see *à priori*, that *every* method, for calculating a root x of the

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general quadratic equation as a function of the two coefficients, by any finite number of additions, subtractions, multiplications, divisions, elevations to powers, and extractions of prime radicals, (these last extractions being supposed to be reduced to the smallest possible number,) *must* involve the extraction of some one square-root of the form

$$a_1' = \sqrt{b^2 (a_1^2 - 4 a_2)},$$

and must *not* involve the extraction of any other radical. But this square-root a_1' is not essentially distinct from that which is usually assigned for the solution of the general quadratic: it is therefore impossible to discover any *new* irrational expression, finite and irreducible, for a root of that general quadratic, essentially distinct from the expressions which have long been known: and the only possible difference between the extractions of radicals which are required in any two methods of solution, if neither method require any superfluous extraction, is that these methods may introduce different square factors into the expressions of that quantity or function f_1, of which, in each, the square root a_1' is to be calculated.

[14.] Proceeding to the general cubic,

$$x^3 + a_1 x^2 + a_2 x + a_3 = 0,$$

we know, first, that the three coefficients are symmetric functions of the three roots,

$$a_1 = -(x_1 + x_2 + x_3), \quad a_2 = x_1 x_2 + x_1 x_3 + x_2 x_3, \quad a_3 = -x_1 x_2 x_3,$$

so that we cannot express any one of these three arbitrary roots x_1, x_2, x_3, as a rational function b of the three coefficients a_1, a_2, a_3; we must therefore inquire whether it can be expressed as an irrational function $b^{(m)}$, involving at least one radical a_1' of the first order, which is to satisfy the two conditions,

$$a_1'^{a_1'} = f_1(x_1, x_2, x_3),$$

and

$$a_1' = F_1'(a_1, a_2, a_3);$$

the functions f_1 and F_1' being rational, and the prime exponent a_1' being either 2 or 3, because it is to be equal to the number of values of the rational function

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F_1', obtained by changing in all possible ways the arrangement of the three roots x_1, x_2, x_3, and therefore must be a divisor of the product $1.2.3 = 6$.

Now by the properties of rational functions of three variables, (of which an investigation shall soon be given, but which it is convenient merely to enunciate here, that the course of the main argument may not be too much interrupted,) no three-valued function of three arbitrary quantities x_1, x_2, x_3, can have a symmetric cube; and the only two-valued functions, which have symmetric squares, are of the form

$$b\,(x_1 - x_2)\,(x_1 - x_3)\,(x_2 - x_3),$$

b being a symmetric but otherwise arbitrary multiplier. We must therefore suppose, that the radical a_1' is a square-root, and that it may be thus expressed:

$$\begin{aligned} a_1' = \mathrm{F}_1'(x_1, x_2, x_3) &= b\,(x_1 - x_2)\,(x_1 - x_3)\,(x_2 - x_3) \\ &= \sqrt{\{b^2\,(x_1 - x_2)^2\,(x_1 - x_3)^2\,(x_2 - x_3)^2\}} \\ &= \sqrt{\{b^2\,(a_1^2 a_2^2 - 4\,a_1^3 a_3 - 4\,a_2^3 + 18\,a_1 a_2 a_3 - 27\,a_3^2)\}} \\ &= \sqrt{-108\,b^2\,(c_1^3 - c_2^2)}, \end{aligned}$$

b being here rational with respect to a_1, a_2, a_3, as also are c_1 and c_2, which last have the same meanings here as in the second article; so that the function f_1 is of the form,

$$f_1(a_1, a_2, a_3) = -108\,b^2\,(c_1^3 - c_2^2).$$

No other radical of the first order, a_2', can enter into the sought irreducible expression $b^{(m)}$; because the same reasoning would give

$$a_2' = c\,(x_1 - x_2)\,(x_1 - x_3)\,(x_2 - x_3) = \frac{c}{b}\,a_1',$$

c being rational with respect to a_1, a_2, a_3, so that the radical a_2' would be superfluous. On the other hand, no expression of the form $b_0 + b_1 a_1'$ can represent the three-valued function x; we must therefore suppose that if the sought expression $b^{(m)}$ exist at all, it is, at lowest, of the second order, and involves at least one radical a_1'', such that

$$a_1''^{a_1''} = (f_1' =)\,b_0 + b_1 a_1',$$

and

$$a_1'' = \mathrm{F}_1''(x_1, x_2, x_3);$$

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the rational function F_1'' admitting of $2\,a_1''$ values, and consequently the exponent a_1'' being $= 3$, (since it cannot be $= 2$, because no function of three variables has exactly four values,) so that we must suppose the radical a_1'' to be a cube-root, of the form

$$a_1'' = \sqrt[3]{b_0 + b_1 a_1'},$$

b_0 and b_1 being rational with respect to a_1, a_2, a_3. But in order that a six-valued rational function F_1'', of three arbitrary quantities x_1, x_2, x_3, should have a two-valued cube, it must be of the form

$$\mathrm{F}_1''(x_1, x_2, x_3) = (p_0 + p_1 a_1')(x_1 + \rho_3^2 x_2 + \rho_3 x_3);$$

in which p_0 and p_1 are symmetric, a_1' has the form recently assigned, and ρ_3 is a root of the numerical equation

$$\rho_3^2 + \rho_3 + 1 = 0;$$

we must therefore suppose that

$$a_1'' = (p_0 + p_1 a_1')(x_1 + \rho_3^2 x_2 + \rho_3 x_3),$$

and

$$b_0 + b_1 a_1' = 27\,(p_0 + p_1 a_1')^3 \left\{c_1 + \tfrac{1}{18}(\rho_3^2 - \rho_3)\frac{a_1'}{b}\right\},$$

c_1 retaining here its recent meaning; so that the radical a_1'' may be considered as the cube-root of this last expression. If any other radical a_2'' of the second order could enter into the composition of $b^{(m)}$, it ought, for the same reasons, to be either of the form

$$a_2'' = (q_0 + q_1 a_1')(x_1 + \rho_3^2 x_2 + \rho_3 x_3),$$

or else of the form

$$a_2'' = (q_0 + q_1 a_1')(x_1 + \rho_3 x_2 + \rho_3^2 x_3),$$

ρ_3 being here the same root of the numerical equation $\rho_3^2 + \rho_3 + 1 = 0$, as in the expression for a_1''; we should therefore have either the relation

$$a_2'' = \frac{q_0 + q_1 a_1'}{p_0 + p_1 a_1'}\, a_1'',$$

or else the relation

$$a_2^3 = \frac{9\,c_2\,(p_0 + p_1 a_1)(q_0 + q_1 a_1')}{a_1''},$$

c_1 retaining its recent meaning; so that in each case it would be superfluous to perform any new extraction of a cube-root or other radical in order to calculate a_2'', after a_1' and a_1'' had been calculated; and consequently no such other radical a_2'' of the second order can enter into the composition of the irreducible function $b^{(m)}$. If then that function be itself of the second order, it must be capable of being put under the form

$$b'' = b_0' + b_1' a_1'' + b_2' a_1''^2,$$

b_0', b_1', b_2', being functions of the forms

$$b_0' = (b_0')_0 + (b_0')_1 a_1',$$
$$b_1' = (b_1')_0 + (b_1')_1 a_1',$$
$$b_2' = (b_2')_0 + (b_2')_1 a_1',$$

in which the radicals a_1' and a_1'' have the forms lately found, and $(b_0')_0, \ldots (b_2')_1$ are rational functions of a_1, a_2, a_3. And on the same supposition, the three roots x_1, x_2, x_3, of that equation must, in some arrangement or other, be represented by the three expressions,

$$x_\alpha = b_0'' = b_0' + b_1' a_1'' + b_2' a_1''^2,$$
$$x_\beta = b_1'' = b_0' + \rho_3 b_1' a_1'' + \rho_3^2 b_2' a_1''^2,$$
$$x_\gamma = b_2'' = b_0' + \rho_3^2 b_1' a_1'' + \rho_3 b_2' a_1''^2,$$

ρ_3 retaining here its recent value: which expressions reciprocally will be true, if the following relations,

$$b_0' = \tfrac{1}{3}(x_\alpha + x_\beta + x_\gamma),$$
$$b_1' a_1'' = \tfrac{1}{3}(x_\alpha + \rho_3^2 x_\beta + \rho_3 x_\gamma),$$
$$b_2' a_1''^2 = \tfrac{1}{3}(x_\alpha + \rho_3 x_\beta + \rho_3^2 x_\gamma),$$

can be made to hold good, by any suitable arrangement of the roots $x_\alpha, x_\beta, x_\gamma$, and by any suitable selection of those rational functions of a_1, a_2, a_3, which have hitherto been left undetermined. Now, for this purpose it is necessary and sufficient that the arrangement of the roots $x_\alpha, x_\beta, x_\gamma$, should coincide with one or other of the three following arrangements, namely x_1, x_2, x_3, or x_2, x_3, x_1,

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or x_3, x_1, x_2; the value of $3\,b_1'\,(p_0 + p_1\,a_1')$ being, in the first case, unity; in the second case, ρ_3; and, in the third case, ρ_3^2; while, in every case, the value of b_0' is to be $\frac{-a_1}{3}$, and that of $b_1'\,b_2'\,(b_0 + b_1\,a_1')$ is to be c_2. All these suppositions are compatible with the conditions assigned before; nor is there any essential difference between the three cases of arrangement just now mentioned, since the passage from any one to any other may be made (as we have seen) by merely multiplying the coefficient b_1', which admits of an arbitrary multiplier, by an imaginary cube-root of unity. We have, therefore, the following irrational and irreducible expression for the root x of the general cubic, as a function of the second order,

$$x = b'' = \frac{-a_1}{3} + \frac{a_1''}{3(p_0 + p_1 a_1')} + \frac{3c_2(p_0 + p_1 a_1')}{a_1''};$$

in which it is to be remembered that

$$a_1''^2 = 27\,(p_0 + p_1 a_1')^3 \left\{c_1 + \tfrac{1}{18}(\rho_3^2 - \rho_3)\frac{a_1'}{b}\right\},$$

and that

$$a_1'^2 = -\,108\,b^3(c_1^2 - c_2^3);$$

c_1 and c_2 having the determined values above referred to, namely

$$c_1 = \tfrac{-1}{3^3}(2a_1^3 - 9a_1 a_2 + 27a_3),\ \ c_2 = \tfrac{1}{9}(a_1^2 - 3a_2),$$

and ρ_3 being an imaginary cube-root of unity, but b and p_0, p_1, being any arbitrary rational functions of a_1, a_2, a_3, or even any arbitrary numeric constants; except that b must be different from 0, and that p_0, p_1 must not both together vanish. (In the formulæ of the earlier articles of this essay, these three last quantities had the following particular values,

$$b = \tfrac{1}{18}(\rho_3^2 - \rho_3),\ \ p_0 = \tfrac{1}{3},\ \ p_1 = 0.)$$

By substituting for the cubic radical a_1'' the three unequal values a_1'', $\rho_3\,a_1''$, $\rho_3^2\,a_1''$, in the general expression, just now found, for x, we obtain separate and unequal expressions for the three separate roots x_1, x_2, x_3; these roots, and every rational function of them, may consequently be expressed as rational functions of the two radicals a_1' and a_1''; and therefore it is unnecessary and improper, in the present research, to introduce any other radical. But these two radicals a_1' and a_1'' are not essentially distinct from those which enter into the usual formulæ

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for the solution of a cubic equation: it is therefore impossible to discover any *new* irrational expression, finite and irreducible, for a root of the general cubic, *essentially distinct* from those which have long been known; and the only possible difference, with respect to the extracting of radicals, between any two methods of solution which both are free from all superfluous extractions, consists in the introduction of different square factors into that quantity or function f_1, of which, in each, the square root a_1' is to be calculated; or in the introduction of different cubic factors into that other quantity or function f_1', of which, in each method, it is requisite to calculate the cube-root a_1''. It is proper, however, to remember the remarks which have been made, in a foregoing article, respecting the *reducibility* of a certain expression, involving *two* cubic radicals a_1'' and a_2'', which is not uncommonly assigned for a root of the cubic equation.

[15.] But it is necessary to demonstrate some properties of rational functions of three variables, which have been employed in the foregoing investigation. And because it will be necessary to investigate afterwards some analogous properties of functions of four and five arbitrary quantities, it may be conducive to clearness and uniformity that we should begin with a few remarks respecting functions which involve two variables only.

Let $\mathrm{F}(x_\alpha, x_\beta)$ denote any arbitrary rational function of two arbitrary quantities x_1, x_2, arranged in either of their only two possible arrangements; so that the function F admits of the two following values

$$\mathrm{F}(x_1, x_2) \text{ and } \mathrm{F}(x_2, x_1),$$

which for conciseness may be thus denoted,

$$(1, 2) \text{ and } (2, 1).$$

These different *values* of the proposed function F may also be considered as being themselves two different *functions* of the same two quantities x_1, x_2 taken in some determined order; and may, in this view, be denoted thus,

$$\mathrm{F}_1(x_1, x_2) \text{ and } \mathrm{F}_2(x_1, x_2),$$

or, more concisely,

$$(1, 2)_1 \text{ and } (1, 2)_2:$$

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they may also, on account of the mode in which they are formed from one common type $\mathrm{F}(x_\alpha, x_\beta)$, be said to be *syntypical functions*. For example, the two values,

$$ax_1 + bx_2 = (1, 2) = \mathrm{F}(x_1, x_2) = \mathrm{F}_1(x_1, x_2) = (1, 2)_1,$$

and

$$ax_2 + bx_1 = (2, 1) = \mathrm{F}(x_2, x_1) = \mathrm{F}_2(x_1, x_2) = (1, 2)_2,$$

of the function $ax_\alpha + bx_\beta$, may be considered as being two different but *syntypical* functions of the two variables x_1 and x_2. And again, in the same sense, the functions $\frac{x_1^2}{x_2}$ and $\frac{x_2^2}{x_1}$ are syntypical.

Now although, in general, two such syntypical functions, F_1 and F_2, are unconnected by any relation among themselves, on account of the independence of the two arbitrary quantities x_1 and x_2; yet, for some *particular forms* of the original or typical function F_1, they may become connected by some such relation, without any restriction being thereby imposed on those two arbitrary quantities. But all such relations may easily be investigated, with the help of the two general forms obtained in the thirteenth article, namely,

$$\mathrm{F}_1 = a + b(x_1 - x_2), \quad \mathrm{F}_2 = a - b(x_1 - x_2),$$

in which a and b are symmetric. For example, we see from these forms that the two syntypical functions F_1 and F_2 become equal, when they reduce themselves to the symmetric term or function a, but not in any other case; and that their squares are equal without their being equal themselves, if they are of the forms $\pm b(x_1 - x_2)$, but not otherwise. We see, too, that we cannot suppose $\mathrm{F}_2 = \rho_3 \mathrm{F}_1$, without making a and b both vanish; and therefore that two syntypical functions of two arbitrary quantities cannot have equal cubes, if they be themselves unequal.

[16.] After these preliminary remarks respecting functions of two variables, let us now pass to functions of three; and accordingly let $\mathrm{F}(x_\alpha, x_\beta, x_\gamma)$, or more concisely (α, β, γ), denote any arbitrary rational function of any three arbitrary and independent quantities x_1, x_2, x_3, arranged in any arbitrary order. It is clear that this function F has in general six different values, namely,

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$$(1, 2, 3),\ (2, 3, 1),\ (3, 1, 2),\ (2, 1, 3),\ (3, 2, 1),\ (1, 3, 2),$$

or, in a more developed notation,

$$\mathrm{F}(x_1, x_2, x_3), \ldots \mathrm{F}(x_1, x_3, x_2),$$

corresponding to the six different possible arrangements of the three quantities on which it is supposed to depend; and that these six *values* of the function F may also be considered as six different but *syntypical functions* of the same three arbitrary quantities x_1, x_2, x_3, taken in some determined order; which functions may be thus denoted,

$$\mathrm{F}_1(x_1, x_2, x_3), \ldots \mathrm{F}_6(x_1, x_2, x_3),$$

or, more concisely,

$$(1, 2, 3)_1, \ldots (1, 2, 3)_6.$$

For example, the six following values,

$$\begin{aligned}
ax_1 + bx_2 + cx_3 &= (1, 2, 3) = \mathrm{F}(x_1, x_2, x_3),\\
ax_2 + bx_3 + cx_1 &= (2, 3, 1) = \mathrm{F}(x_2, x_3, x_1),\\
ax_3 + bx_1 + cx_2 &= (3, 1, 2) = \mathrm{F}(x_3, x_1, x_2),\\
ax_2 + bx_1 + cx_3 &= (2, 1, 3) = \mathrm{F}(x_2, x_1, x_3),\\
ax_3 + bx_2 + cx_1 &= (3, 2, 1) = \mathrm{F}(x_3, x_2, x_1),\\
ax_1 + bx_3 + cx_2 &= (1, 3, 2) = \mathrm{F}(x_1, x_3, x_2),
\end{aligned}$$

of the original or typical function

$$ax_\alpha + bx_\beta + cx_\gamma = \mathrm{F}(x_\alpha, x_\beta, x_\gamma),$$

may be considered as being six syntypical functions, $\mathrm{F}_1, \mathrm{F}_2, \mathrm{F}_3, \mathrm{F}_4, \mathrm{F}_5, \mathrm{F}_6$, of the three quantities x_1, x_2, x_3. Such also are the six following,

$$\frac{x_1}{x_2} + x_3,\ \frac{x_2}{x_3} + x_1,\ \frac{x_3}{x_1} + x_2,\ \frac{x_2}{x_1} + x_3,\ \frac{x_3}{x_2} + x_1,\ \frac{x_1}{x_3} + x_2,$$

which are the values of the function $\frac{x_\alpha}{x_\beta} + x_\gamma$.

Now, in general, six such syntypical functions of three arbitrary quantities are all unequal among themselves; nor can any ratio or other relation between them be assigned, (except that very relation which constitutes them syntypical,)

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so long as the form of the function F, although it has been supposed to be rational, remains otherwise entirely undetermined. But, for some *particular forms* of this original or typical function $F(x_\alpha, x_\beta, x_\gamma)$, relations may arise between the six syntypical functions $F_1, \ldots F_6$, without any restriction being thereby imposed on the three arbitrary quantities x_1, x_2, x_3; for example, the function F may be partially or wholly symmetric, and then the functions $F_1, \ldots F_6$ will, some or all, be equal. And we are now to study the chief *functional conditions*, under which relations of this kind can arise. More precisely, we are to examine what are the conditions under which the number of the values of a rational function F of three variables, or of the square or cube of that function, can reduce itself below the number six, in consequence of two or more of the six syntypical functions $F_1, \ldots F_6$, or of their squares or cubes, which are themselves syntypical, becoming equal to each other. And for this purpose we must first inquire into the conditions requisite in order that any *two* syntypical functions, or that any two values of F, may be equal.

[17.] If any two such values be denoted by the symbols

$$F(x_{\alpha_1}, x_{\beta_1}, x_{\gamma_1}), \quad \text{and} \quad F(x_{\alpha_2}, x_{\beta_2}, x_{\gamma_2}),$$

or, more concisely, by the following,

$$(\alpha_1, \beta_1, \gamma_1) \text{ and } (\alpha_2, \beta_2, \gamma_2),$$

it is clear that in passing from the one to the other, and therefore in passing from some one arrangement to some other of the three indices α, β, γ, (which must themselves coincide, in some arrangement or other, with the numbers 1, 2, 3,) we must have changed some index, such as α, to some other, such as β, which must also have been changed, itself, either to α or to γ; this latter index γ remaining in the first case unaltered, but being changed to α in the second case. And, in whatever order the indices $\alpha_1, \beta_1, \gamma_1$ may have coincided with α, β, γ, it is obvious that the function

$$F(x_{\alpha_1}, x_{\beta_1}, x_{\gamma_1}) \text{ or } (\alpha_1, \beta_1, \gamma_1)$$

must coincide with the syntypical function

$$F_i(x_\alpha, x_\beta, x_\gamma) \text{ or } (\alpha, \beta, \gamma)_i,$$

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for some suitable index i, belonging to the system 1, 2, 3, 4, 5, 6; the equation

$$(\alpha_i, \beta_i, \gamma_i) = (\alpha_e, \beta_e, \gamma_e),$$

is therefore equivalent to one or other of the two following, namely, either

$$1\text{st}, \ldots (\alpha, \beta, \gamma)_i = (\beta, \alpha, \gamma)_i,$$

or

$$2\text{nd}, \ldots (\alpha, \beta, \gamma)_i = (\beta, \gamma, \alpha)_i.$$

In the first case, the function F_i is symmetric with respect to the two quantities x_α, x_β, and therefore involves them only by involving their sum and product, which may be thus expressed,

$$x_\alpha + x_\beta = -a_1 - x_\gamma, \quad x_\alpha x_\beta = a_2 + a_1 x_\gamma + x_\gamma^2,$$

a_1 and a_2 being symmetric functions of the three quantities x_1, x_2, x_3, namely, the following,

$$a_1 = -(x_1 + x_2 + x_3), \quad a_2 = x_1 x_2 + x_1 x_3 + x_2 x_3;$$

so that if we put, for abridgment,

$$a_3 = -x_1 x_2 x_3,$$

the three quantities x_1, x_2, x_3 will be the three roots of the cubic equation

$$x^3 + a_1 x^2 + a_2 x + a_3 = 0.$$

In this case, therefore, we may consider F_i as being a rational function of the root x_γ alone, which function will however involve, in general, the coefficients a_1 and a_2; and we may put

$$\mathrm{F}_i(x_\alpha, x_\beta, x_\gamma) = \frac{\phi(x_\gamma)}{\chi(x_\gamma)}$$

$$= \frac{\chi(x_\alpha) \cdot \chi(x_\beta) \cdot \phi(x_\gamma)}{\chi(x_\alpha) \cdot \chi(x_\beta) \cdot \chi(x_\gamma)} = \psi(x_\gamma),$$

ϕ, χ, and ψ denoting here some rational and whole functions of x_γ, which may however involve rationally the coefficients of the foregoing cubic equation. And

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since it is unnecessary, on account of that equation, to retain in evidence the cube or any higher powers of x_γ, we may write simply

$$\mathrm{F}_i(x_\alpha, x_\beta, x_\gamma) = a + bx_\gamma + cx_\gamma^2,$$

a, b, c being here symmetric functions of the three quantities x_1, x_2, x_3: so that, in this case, the six syntypical functions, or values of the function F, reduce themselves to the three following

$$a + bx_1 + cx_1^2,\ a + bx_2 + cx_2^2,\ a + bx_3 + cx_3^2.$$

Nor can these three reduce themselves to any smaller number, without their all becoming equal and symmetric, by the vanishing of b and c.

In the second case, the form of F_i being such that

$$(\alpha, \beta, \gamma)_i = (\beta, \gamma, \alpha)_i,$$

it must also be such that

$$(\beta, \gamma, \alpha)_i = (\gamma, \alpha, \beta)_i;$$

for the same reason we must have

$$(\beta, \alpha, \gamma)_i = (\alpha, \gamma, \beta)_i = (\gamma, \beta, \alpha)_i,$$

so that the function changes when any two of the three indices are interchanged, but returns to its former value when any two are interchanged again; from which it results that the two following combinations

$$(\alpha, \beta, \gamma)_i + (\beta, \alpha, \gamma)_i \text{ and } \frac{(\alpha, \beta, \gamma)_i - (\beta, \alpha, \gamma)_i}{(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma)}$$

remain unchanged, after all interchanges of the indices, and are therefore symmetric functions, such as $2a$ and $2b$, of the three quantities x_1, x_2, x_3: so that we may write

$$\mathrm{F}_i(x_\alpha, x_\beta, x_\gamma) = (\alpha, \beta, \gamma)_i = a + b(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma);$$

and consequently the six syntypical functions, or values of the function F, reduce themselves in this case to the two following,

$$a \pm b(x_1 - x_2)(x_1 - x_3)(x_2 - x_3),$$

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in which a and b are symmetric. It is evident that any farther diminution of the number of values of F, conducts, in this case also, to the one-valued or symmetric function a.

Combining the foregoing results, we see that if an unsymmetric rational function of three arbitrary quantities have fewer than six values, it must be reducible either to the two-valued form

$$a + b\,(x_1 - x_2)\,(x_1 - x_3)\,(x_2 - x_3),$$

or to the three-valued form

$$a + bx + cx^2.$$

[18.] It is possible, however, that some analogous but different reduction may cause either—I. the square, or II. the cube of a function F of three variables, to have a smaller number of values than the function F itself. But, for this purpose, it is necessary that we should now have a relation of one or other of the two forms following, namely, either

$$\text{I.} \ldots (\alpha_2, \beta_2, \gamma_2) = -(\alpha_1, \beta_1, \gamma_1)$$

or

$$\text{II.} \ldots (\alpha_2, \beta_2, \gamma_2) = \rho_3 (\alpha_1, \beta_1, \gamma_1),$$

(ρ_3 denoting, as above, an imaginary cube root of unity,) instead of the old functional relation $(\alpha_2, \beta_2, \gamma_2) = (\alpha_1, \beta_1, \gamma_1)$. And as we found ourselves permitted, before, to change that old relation to one or other of these two,

$$\text{1st, } (\beta, \alpha, \gamma)_i = (\alpha, \beta, \gamma)_i; \quad \text{2nd, } (\beta, \gamma, \alpha)_i = (\alpha, \beta, \gamma)_i;$$

so are we now allowed to change the two new relations to the four following :

$$\text{I. } 1, \ldots (\beta, \alpha, \gamma)_i = -(\alpha, \beta, \gamma)_i; \quad \text{I. } 2, \ldots (\beta, \gamma, \alpha)_i = -(\alpha, \beta, \gamma)_i;$$

$$\text{II. } 1, \ldots (\beta, \alpha, \gamma)_i = \rho_3 (\alpha, \beta, \gamma)_i; \quad \text{II. } 2, \ldots (\beta, \gamma, \alpha)_i = \rho_3 (\alpha, \beta, \gamma)_i;$$

the relation (I.) admitting of being changed to one or other of the two marked (I. 1) and (I. 2); and the relation (II.) admitting, in like manner, of being changed either to (II. 1) or to (II. 2). But the relations (I. 2) and (II. 1) conduct only to evanescent functions, because (I. 2) gives

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$$(\gamma, \alpha, \beta)_i = -(\beta, \gamma, \alpha)_i = +(\alpha, \beta, \gamma)_i,$$
$$(\alpha, \beta, \gamma)_i = -(\gamma, \alpha, \beta)_i = -(\alpha, \beta, \gamma)_i,$$

and (II. 1) gives

$$(\alpha, \beta, \gamma)_i = \rho_3 (\beta, \alpha, \gamma)_i = \rho_3^2 (\alpha, \beta, \gamma)_i :$$

we may therefore confine our attention to the other two relations. Of these, (I. 1) requires that the function $\frac{(\alpha, \beta, \gamma)_i}{x_\alpha - x_\beta}$ should not change its value when x_α and x_β are interchanged, and consequently, by what was shown above, that it should be reducible to the form $a + bx_\gamma + cx_\gamma^2$; in this case, therefore, we have the expression,

$$(\alpha, \beta, \gamma)_i = \mathrm{P}_i (x_\alpha, x_\beta, x_\gamma) = (x_\alpha - x_\beta)(a + bx_\gamma + cx_\gamma^2),$$

the coefficients a, b, c, being symmetric functions of x_1, x_2, x_3. Accordingly the square of this function P_i admits in general of three values only, while the function is itself in general six-valued; because the square of the factor $x_\alpha - x_\beta$, but not that factor itself, can be expressed as a rational function of x_γ, and of the quantities a_1, a_2, a_3, which are symmetric relatively to x_1, x_2, x_3. It may even happen that the function itself shall have only two values, and that its square shall be symmetric, namely, by the factor $a + bx_\gamma + cx_\gamma^2$ being reducible to the form $b(x_\alpha - x_\gamma)(x_\beta - x_\gamma)$, in which the coefficient b is some new symmetric function; but the results of the last article enable us to see that the functions thus obtained, namely, those of the form

$$b(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma),$$

or more simply of the form

$$b(x_1 - x_2)(x_1 - x_3)(x_2 - x_3),$$

are the only two-valued functions of three variables which have symmetric squares: they enable us also to see easily that the square of a three-valued function of three variables is always itself three-valued. It remains, then, only to consider the relation (II. 2); which requires that the function

$$\frac{(\alpha, \beta, \gamma)_i}{x_\alpha + \rho^3 x_\beta + \rho_3 x_\gamma}$$

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should be of the two-valued form $a+b\,(x_\alpha-x_\beta)\,(x_\alpha-x_\gamma)\,(x_\beta-x_\gamma)$; because, if we denote it by $\phi\,(x_\alpha, x_\beta, x_\gamma)$, we have

$$\phi\,(x_\alpha, x_\beta, x_\gamma) = \phi\,(x_\beta, x_\gamma, x_\alpha) = \phi\,(x_\gamma, x_\alpha, x_\beta),$$

and

$$\phi\,(x_\beta, x_\alpha, x_\gamma) = \phi\,(x_\alpha, x_\gamma, x_\beta) = \phi\,(x_\gamma, x_\beta, x_\alpha);$$

we have, therefore, in this case,

$$(\alpha, \beta, \gamma_i) = F_i\,(x_\alpha, x_\beta, x_\gamma)$$
$$= \{a+b\,(x_\alpha-x_\beta)\,(x_\alpha-x_\gamma)\,(x_\beta-x_\gamma)\}\,(x_\alpha+\rho_3^2\,x_\beta+\rho_3\,x_\gamma),$$

a and b being symmetric coefficients, which must not both together vanish; and accordingly we find, *à posteriori*, that whereas this function F_i has always itself six values, its cube has only two. The foregoing analysis shows at the same time, that if an unsymmetric function of three variables have fewer than six values, its cube cannot have fewer values than itself; and accordingly it is easy to see that the cubes of those two-valued and three-valued functions, which were assigned in the last article, are themselves two-valued and three-valued. In fact, the passage from any one to any other of the values of any such (two-valued or three valued) function, may be performed by interchanging some two of the three quantities x_1, x_2, x_3; and if such interchange could have the effect of multiplying the function by an imaginary cube-root of unity, ρ_3, another interchange of the same two quantities would multiply again by the same factor ρ_3; and therefore these two interchanges combined would multiply by ρ_3^2, which is a factor different from unity, although any two such successive interchanges of any two quantities x_α, x_β, ought to make no change in the function. If, then, a rational function of three arbitrary quantities have a symmetric cube, it must be itself symmetric.

The form of that six-valued function of three variables which has a two-valued cube, may also be thus deduced, from the functional relation (II. 2). Omitting for simplicity, the lower index i, which is not essential to the reasoning, we find, by that relation,

$$(\beta, \gamma, \alpha) = \rho_3\,(\alpha, \beta, \gamma); \quad (\gamma, \alpha, \beta) = \rho_3^2\,(\alpha, \beta, \gamma);$$
$$(\gamma, \beta, \alpha) = \rho_3\,(\alpha, \gamma, \beta); \quad (\beta, \alpha, \gamma) = \rho_3^2\,(\alpha, \gamma, \beta);$$

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so that

$$(\alpha, \beta, \gamma) \cdot (\alpha, \gamma, \beta) = (\beta, \gamma, \alpha)\ (\beta, \alpha, \gamma) = (\gamma, \alpha, \beta)\ (\gamma, \beta, \alpha) = e,$$

this product e being some symmetric function; at the same time, the sum $(\alpha, \beta, \gamma) + (\alpha, \gamma, \beta)$ is a three-valued function y_α, which may be put under the form

$$y_\alpha = a + bx_\alpha + cx_\alpha^2,$$

a, b, and c being symmetric, and b and c being obliged not both to vanish. Attending therefore to that cubic equation of which x_α, x_β, and x_γ are the roots, we have

$$y_\alpha^3 = a' + b' x_\alpha + c' x_\alpha^2,$$

a', b', and c' denoting here some symmetric functions, and c, c' being obliged not both to vanish; and consequently, by eliminating x_α^2, we obtain an equation of the form

$$(bc' - cb')\, x_\alpha = ca' - ac' + c'' y_\alpha - c y^3,$$

in which the coefficients of y_α and y_α^2 cannot both vanish, and in which therefore the coefficient of x_α cannot vanish, because the three-valued function y_α must not be a root of any equation with symmetric coefficients, below the third degree; we have therefore an expression of the form

$$x_\alpha = p + q y_\alpha + r y_\alpha^3,$$

in which, p, q, r are symmetric, and q and r do not both vanish. But

$$y_\alpha = (\alpha, \beta, \gamma) + (\alpha, \gamma, \beta) = (\alpha, \beta, \gamma) + \frac{e}{(\alpha, \beta, \gamma)};$$

and the cube of (α, β, γ) is a two-valued function; therefore

$$x_\alpha = p' + q'\ (\alpha, \beta, \gamma) + r'\ (\alpha, \beta, \gamma)^3,$$

the functions p', q', r' being either symmetric or two-valued, and consequently undergoing no change, when we pass successively from the first to the second, or from the second to the third, of the three functions (α, β, γ), (β, γ, α), (γ, α, β), by changing at each passage, x_α to x_β, x_β to x_γ, and x_γ to x_α; and we have seen

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that these three last-mentioned functions bear to each other the same ratios as the three cube-roots of unity, $1, \rho_3, \rho_3^2$; we have therefore

$$x_\beta = p' + q' \rho_3 (\alpha, \beta, \gamma) + r' \rho_3^2 (\alpha, \beta, \gamma)^2,$$
$$x_\gamma = p' + q' \rho_3^2 (\alpha, \beta, \gamma) + r' \rho_3 (\alpha, \beta, \gamma)^2;$$

and thus, finally, the six-valued function which has a two-valued cube is found anew to be expressible as follows,

$$(\alpha, \beta, \gamma) = \frac{1}{3q'} (x_\alpha + \rho_3^2 x_\beta + \rho_3 x_\gamma);$$

in which the coefficient $\frac{1}{3q'}$ is a two-valued function, of the form

$$\frac{1}{3q'} = a + b (x_1 - x_2) (x_1 - x_3) (x_2 - x_3),$$

a, b, denoting here some new symmetric functions.

The theorems obtained incidentally in this last discussion supply us also with another mode of proving that the cube of a three-valued function of three arbitrary quantities must be itself three-valued: for if we should suppose $y_\beta = \rho_3 y_\alpha$, and consequently $y_\gamma = \rho_3 y_\beta = \rho_3^2 y_\alpha$, in which $y_\alpha = a + b x_\alpha + c x_\alpha^2$, and b and c do not both vanish, we should then have relations of the forms

$$x_\alpha = p + q y_\alpha + r y_\alpha^2,$$
$$x_\beta = p + q \rho_3 y_\alpha + r \rho_3^2 y_\alpha^2,$$
$$x_\gamma = p + q \rho_3^2 y_\alpha + r \rho_3 y_\alpha^2;$$

but these would require that we should have the equation

$$x_\alpha + \rho_3^2 x_\beta + \rho_3 x_\gamma = 3q . y_\alpha,$$

a condition which it is impossible to fulfil, because the first member has six values, and the second only three.

[19.] The discussion of the forms of functions of four variables may now be conducted more briefly, than would have been consistent with clearness, if we had not already treated so fully of functions in which the number of the variables is less than four.

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Let x_1, x_2, x_3, x_4 be any four arbitrary quantities, or roots of the general biquadratic,

$$x^4 + a_1 x^3 + a_2 x^2 + a_3 x + a_4 = 0;$$

and let $\mathrm{F}(x_1, x_2, x_3, x_4)$, or, more concisely, (1, 2, 3, 4), denote any rational function of them. By altering the arrangement of these four roots, we shall in general obtain twenty-four different but *syntypical* functions; of which each, according to the analogy of the foregoing notation, may be denoted by any one of the four following symbols:

$$(\alpha, \beta, \gamma, \delta) = \mathrm{F}(x_\alpha, x_\beta, x_\gamma, x_\delta)$$
$$= (1, 2, 3, 4)_i = \mathrm{F}_i(x_1, x_2, x_3, x_4).$$

In passing from any one to any other of these twenty-four syntypical functions $\mathrm{F}_1, \ldots \mathrm{F}_{24}$, by a change of arrangement of the four roots, some one of these roots, such as the first in order, must be changed to some other, such as the second; and this second must at the same time be changed either to the first or to a different root, such as the third; while, in the former case, the third and fourth roots may either be interchanged among themselves or not; and, in the latter case, the third root may be changed either to the first or to the fourth. We have therefore four and only four distinct sorts of changes of arrangement, which may be typified by the passages from the function $(\alpha, \beta, \gamma, \delta)$ to the four following:

I. . $(\beta, \alpha, \gamma, \delta)$; II. . $(\beta, \alpha, \delta, \gamma)$); III. . $(\beta, \gamma, \alpha, \delta)$; IV. . $(\beta, \gamma, \delta, \alpha)$;

and may be denoted by the four characteristics

$$\nabla_1, \quad \nabla_2, \quad \nabla_3, \quad \nabla_4;$$

or more fully by the following,

$$\overset{a,b}{\nabla}_1, \quad \overset{a,b}{\nabla}_2, \quad \overset{a,b,c}{\nabla}_3, \quad \overset{a,b,c}{\nabla}_4;$$

$\overset{a,b}{\nabla}_1$ implying, when prefixed to any function $(\alpha, \beta, \gamma, \delta)$, that we are to interchange the ath and b^{th} of the roots on which it depends; $\overset{a,b}{\nabla}_2$, that we are to interchange among themselves, not only the ath and b^{th}, but also the cth and d^{th}; $\overset{a,b,c}{\nabla}_3$, that we are to change the ath to the bth, the bth to the cth, and the cth to the

a^{th}; namely, by putting that which had been b^{th} in the place of that which had been a^{th}, and so on; and finally $\overset{a,b,c}{\nabla}_4$, that the ath is to be changed to the bth, the bth to the cth, the cth to the dth, and the dth to the ath: so that we have, in this notation,

$$\text{I.}\ldots\ \overset{1,2}{\nabla}_1(\alpha, \beta, \gamma, \delta) = (\beta, \alpha, \gamma, \delta);$$

$$\text{II.}\ldots\ \overset{1,2}{\nabla}_2(\alpha, \beta, \gamma, \delta) = (\beta, \alpha, \delta, \gamma);$$

$$\text{III.}\ldots\ \overset{1,2,3}{\nabla}_3(\alpha, \beta, \gamma, \delta) = (\beta, \gamma, \alpha, \delta);$$

$$\text{IV.}\ldots\ \overset{1,2,3}{\nabla}_4(\alpha, \beta, \gamma, \delta) = (\beta, \gamma, \delta, \alpha).$$

The first sort of change may be called, altering in a *simple binary cycle*; the second, in a *double binary cycle*; the third, in a *ternary*; and the fourth, in a *quaternary* cycle. And every possible equation,

$$(\alpha_2, \beta_2, \gamma_2, \delta_2) = (\alpha_1, \beta_1, \gamma_1, \delta_1),$$

between any two of the twenty-four syntypical functions F_i, may be denoted by one or other of the four following symbolic forms, in each of which the two members may be conceived to be prefixed to a function such as $(\alpha_1, \beta_1, \gamma_1, \delta_1)$:

$$\text{I.}\ldots\ \overset{a,b}{\nabla}_1 = 1;\quad \text{II.}\ldots\ \overset{a,b}{\nabla}_2 = 1;\quad \text{III.}\ldots\ \overset{a,b,c}{\nabla}_3 = 1;\quad \text{IV.}\ldots\ \overset{a,b,c}{\nabla}_4 = 1;$$

or, without any loss of generality, by one of the four following, in each of which the two members are conceived to be prefixed to a function such as $(\alpha, \beta, \gamma, \delta)_i$:

$$\text{I.}\ldots\ \overset{1,2}{\nabla}_1 = 1;\quad \text{II.}\ldots\ \overset{1,2}{\nabla}_2 = 1;\quad \text{III.}\ldots\ \overset{1,2,3}{\nabla}_3 = 1;\quad \text{IV.}\ldots\ \overset{1,2,3}{\nabla}_4 = 1;$$

the Ist and IInd suppositions conducting to twelve-valued functions, the IIIrd to an eight-valued, and the IVth to a six-valued function; while every possible pair of equations between any three of the same twenty-four syntypical functions, if it be not included in a single equation of this last set, may be put under one or other of the six following forms:

$$(\text{I. I.})\ldots\ \overset{1,2}{\nabla}_1 = 1,\ \overset{1,3}{\nabla}_1 = 1;\quad (\text{I. I.})'\ldots\ \overset{1,2}{\nabla}_1 = 1,\ \overset{3,4}{\nabla}_1 = 1;$$

$$(\text{I. II.})\ldots\ \overset{1,2}{\nabla}_1 = 1,\ \overset{1,3}{\nabla}_2 = 1;\quad (\text{I. III.})\ldots\ \overset{1,2}{\nabla}_1 = 1,\ \overset{2,3,4}{\nabla}_3 = 1;$$

$$(\text{II. II.})\ldots\ \overset{1,2}{\nabla}_2 = 1,\ \overset{1,3}{\nabla}_2 = 1;\quad (\text{II. III.})\ldots\ \overset{1,2}{\nabla}_2 = 1,\ \overset{1,2,3}{\nabla}_3 = 1;$$

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which conduct respectively to functions with four, six, three, one, six, and two values; nor can any form of condition, essentially distinct from all the ten last mentioned, be obtained by supposing any three or more equations to exist between the twenty-four functions F_i.

A little attention will not fail to evince the justice of this enumeration of the conditions under which a rational function of four arbitrary variables can have fewer than twenty-four values: yet it may not be useless to remark, as connected with this inquiry, that, in virtue of the notation here employed, the supposition $\overset{a,b}{\nabla}_1 = 1$ involves the supposition $\overset{b,a}{\nabla}_1 = 1$; the supposition $\overset{a,b}{\nabla}_2 = 1$ involves the suppositions $\overset{b,a}{\nabla}_2 = 1$, $\overset{c,d}{\nabla}_2 = 1$, $\overset{d,c}{\nabla}_2 = 1$; $\overset{a,b,c}{\nabla}_3 = 1$ involves $\overset{b,c,a}{\nabla}_3 = 1$, $\overset{c,a,b}{\nabla}_3 = 1$, $\overset{a,c,b}{\nabla}_3 = 1$, $\overset{c,b,a}{\nabla}_3 = 1$, $\overset{b,a,c}{\nabla}_3 = 1$; $\overset{a,b,c}{\nabla}_4 = 1$ involves $\overset{b,c,d}{\nabla}_4 = 1$, $\overset{c,d,a}{\nabla}_4 = 1$, $\overset{d,a,b}{\nabla}_4 = 1$, $\overset{a,c}{\nabla}_2 = 1$, $\overset{a,d,c}{\nabla}_4 = 1$, $\overset{d,c,b}{\nabla}_4 = 1$, $\overset{c,b,a}{\nabla}_4 = 1$, $\overset{b,a,d}{\nabla}_4 = 1$; while the system $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,b}{\nabla}_2 = 1$ is equivalent to the system $\overset{a,b}{\nabla}_1 = 1$, $\overset{c,d}{\nabla}_1 = 1$; $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,b,c}{\nabla}_3 = 1$, to $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,c}{\nabla}_1 = 1$; $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,b,c}{\nabla}_4 = 1$, to $\overset{a,b}{\nabla}_1 = 1$, $\overset{b,c,d}{\nabla}_3 = 1$; $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,c,b}{\nabla}_4 = 1$, to $\overset{a,b}{\nabla}_1 = 1$, $\overset{a,c}{\nabla}_2 = 1$; $\overset{a,b}{\nabla}_2 = 1$, $\overset{a,b,c}{\nabla}_4 = 1$, to $\overset{a,b}{\nabla}_2 = 1$, $\overset{b,d}{\nabla}_1 = 1$; $\overset{a,b,c}{\nabla}_3 = 1$, $\overset{b,c,d}{\nabla}_3 = 1$, to $\overset{a,b}{\nabla}_3 = 1$, $\overset{a,b,c}{\nabla}_3 = 1$; $\overset{a,b,c}{\nabla}_3 = 1$, $\overset{a,b,c}{\nabla}_4 = 1$, to $\overset{a,b,c}{\nabla}_3 = 1$, $\overset{c,d}{\nabla}_1 = 1$; and $\overset{a,b,c}{\nabla}_4 = 1$, $\overset{a,c,b}{\nabla}_4 = 1$, to $\overset{a,b,c}{\nabla}_3 = 1$, $\overset{a,b,c}{\nabla}_4 = 1$: analogous equivalences also holding good for other systems of analogous conditions.

Let us now consider more closely the effects of the ten different suppositions (I.), ... (II. III.).

In the case (I.), the function F is symmetric relatively to some two roots x_α, x_β, and may be put under the form of a rational function of the two others, x_γ, x_δ, or simply of their difference,

$$(\mathrm{I.}) \ldots \mathrm{F} = \phi(x_\gamma - x_\delta);$$

it being understood that this function ϕ may involve the coefficients a_1, a_2, a_3, a_4, which are symmetric relatively to x_1, x_2, x_3, x_4: because it is in general possible to determine rationally any two roots x_γ, x_δ, of an equation of any given degree, when their difference, $x_\gamma - x_\delta$, is given.

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In the case (II.), we may interchange some two roots, x_α, x_β, if we at the same time interchange the two others; and the function may be put under the form

$$\text{(II.)}\ldots\quad \text{F} = \phi(x_\alpha + x_\beta - x_\gamma - x_\delta,\ \overline{x_\alpha - x_\beta}.\ \overline{x_\gamma - x_\delta});$$

because any rational function of the four roots may be considered as a rational function of the four combinations

$$x_\alpha + x_\beta,\ x_\alpha - x_\beta,\ x_\gamma + x_\delta,\ x_\gamma - x_\delta,$$

or of the four following,

$$x_\alpha + x_\beta + x_\gamma + x_\delta,\ x_\alpha + x_\beta - x_\gamma - x_\delta,\ x_\alpha - x_\beta,\ \overline{x_\alpha - x_\beta}.\overline{x_\gamma - x_\delta};$$

of which the first may be omitted, as symmetric, and the third as being here obliged to enter only by its square, which square $(x_\alpha - x_\beta)^2$ is expressible as a rational function of $x_\alpha + x_\beta - x_\gamma - x_\delta$, involving also the symmetric coefficients a_1, a_2, a_3, which are allowed to enter in any manner into ϕ.

In the case (III.), some three roots, x_α, x_β, x_γ, may all be interchanged, the fourth root remaining unaltered; and, on account of what has been shown respecting functions of three variables, we may write

$$\text{(III.)}\ldots\quad \text{F} = \phi(x_\delta) + (x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma)\,\psi(x_\delta),$$

the function ψ (as well as ϕ) being rational.

In the case (IV.), we may change x_α to x_β, if we at the same time change x_β to x_γ, x_γ to x_δ, and x_δ to x_α; and the function F is of the form

$$\text{(IV.)}\ldots\quad \text{F} = \phi(\overline{x_\alpha - x_\beta + x_\gamma - x_\delta}.\ \overline{x_\alpha - x_\gamma}.\ \overline{x_\beta - x_\delta});$$

because the condition $\overset{1,2,3}{\nabla}_4 = 1$ involves the condition $\overset{1,3}{\nabla}_2 = 1$, and consequently the present function F must be rational relatively to the two combinations $x_\alpha + x_\gamma - x_\beta - x_\delta$ and $\overline{x_\alpha - x_\gamma}.\overline{x_\beta - x_\delta}$; or relatively to the two following, $x_\alpha - x_\beta + x_\gamma - x_\delta$ and $\overline{x_\alpha - x_\beta + x_\gamma - x_\delta}.\overline{x_\alpha - x_\gamma}.\overline{x_\beta - x_\delta}$; but of these two last-

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mentioned combinations, the former alone changes, and it changes in its sign alone, when the operation $\overset{1,2,3}{\nabla}_4$ performed, so that it can enter only by its square; which square $(x_\alpha - x_\beta + x_\gamma - x_\delta)^2$ can be expressed as a rational function of the product $(x_\alpha - x_\beta + x_\gamma - x_\delta)\,(x_\alpha - x_\gamma)\,(x_\beta - x_\delta)$, and of those symmetric coefficients which may enter in any manner into ϕ.

By similar reasonings it appears, that in the six other cases, (I. I.)....(II. III.), we have, respectively, the six following forms for F:

$$\text{(I. I.)}\ldots\quad \mathrm{F} = \phi(x_\delta) = a + b\,x_\delta + c\,x_\delta^2 + d\,x_\delta^3;$$

$$\text{(I. I.)}'\ldots.\quad \mathrm{F} = \phi(x_\alpha + x_\beta - x_\gamma - x_\delta);$$

$$\text{(I. II.)}\ldots\quad \mathrm{F} = \phi(x_\alpha x_\beta + x_\gamma x_\delta) = a + b\,(x_\alpha x_\beta + x_\gamma x_\delta) + c\,(x_\alpha x_\beta + x_\gamma x_\delta)^2;$$

$$\text{(I. III.)}\ldots\quad \mathrm{F} = a;$$

$$\text{(II. II.)}\ldots\quad \mathrm{F} = \phi(\overline{x_\alpha - x_\beta}\,.\,\overline{x_\gamma - x_\delta});$$

$$\text{(II. III.)}\ldots\quad \mathrm{F} = a + b\,(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\alpha - x_\delta)(x_\beta - x_\gamma)(x_\beta - x_\delta)(x_\gamma - x_\delta).$$

To one or other of the ten forms last determined, may therefore be reduced every rational function of four arbitrary quantities, which has fewer than twenty-four values. And although the functions (I. I.)′ and (II. II.) are six-valued, as well as the function (IV.), yet these three functions are all in general distinct from one another; the function (IV.) being one which does not change its value, when the four roots $x_\alpha, x_\beta, x_\gamma, x_\delta$ are all changed in some one *quaternary cycle*, but the function (I. I)′ being one which allows *either or both* of *some two pairs* x_α, x_β and x_γ, x_δ to have its two roots interchanged, and the function (II. II.) being characterized by its allowing *any two roots* to be interchanged, if *the two other roots* be interchanged at the same time. It may be useful also to observe, that the three-valued function (I. II) belongs, as a particular case, to each of these three six-valued forms, and may easily be deduced from the form (I. I.)′, as follows:

$$\mathrm{F} = \psi(x_\alpha + x_\beta - x_\gamma - x_\delta) = \psi(x_\gamma + x_\delta - x_\alpha - x_\beta) = \chi\left(\overline{x_\alpha + x_\beta - x_\gamma - x_\delta}^{\,2}\right) = \phi(x_\alpha x_\beta + x_\gamma x_\delta).$$

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Attending next to conditions of the forms

$$\nabla = -1, \ \nabla = \rho_3,$$

instead of attending only to conditions of the form

$$\nabla = 1,$$

we discover the forms which a rational function of four arbitrary variables must have, in order that its square or cube may have fewer values than itself; which functional forms are the following:

The general twenty-four-valued function F will have its square twelve-valued, if it be either of the form

$$F = (x_\alpha - x_\beta) \cdot \psi (x_\gamma - x_\delta),$$

or of this other form

$$F = (x_\alpha - x_\beta) \cdot \psi (x_\alpha + x_\beta - x_\gamma - x_\delta, \overline{x_\alpha - x_\beta} \cdot \overline{x_\gamma - x_\delta}).$$

The same general or twenty-four-valued function will have an eight-valued cube, if it be of the form

$$F = \{\phi (x_\delta) + (x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma) \psi (x_\delta)\}(x_\alpha + \rho_3^2 x_\beta + \rho_3 x_\gamma),$$

ρ_3 being, as before, an imaginary cube-root of unity. The twelve-valued function (I.) will have a six-valued square, if it be reducible to the form

$$F = (x_\gamma - x_\delta) \cdot \psi (x_\alpha + x_\beta - x_\gamma - x_\delta).$$

The twelve-valued function (II.) will have a six-valued square, if it be either of the form

$$F = (x_\alpha + x_\beta - x_\gamma - x_\delta) \cdot \psi (\overline{x_\alpha - x_\beta} \cdot \overline{x_\gamma - x_\delta}),$$

or of the form

$$F = (x_\alpha - x_\beta)(x_\gamma - x_\delta) \cdot \psi (x_\alpha + x_\beta - x_\gamma - x_\delta).$$

The eight-valued function (III.) will have its square four-valued, if it be of the form

$$F = (x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\beta - x_\gamma) \psi (x_\delta).$$

The six-valued functions (IV.), (I. I.)′, (II. II.), will have their squares three-valued, if they be reducible, respectively, to the forms,

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$$\text{F} = (x_\alpha - x_\beta + x_\gamma - x_\delta)(x_\alpha - x_\gamma)(x_\beta - x_\delta) \cdot \psi(x_\alpha x_\gamma + x_\beta x_\delta),$$

$$\text{F} = (x_\alpha + x_\beta - x_\gamma - x_\delta) \cdot \psi(x_\alpha x_\beta + x_\gamma x_\delta),$$

$$\text{F} = (x_\alpha - x_\beta)(x_\gamma - x_\delta) \cdot \psi(x_\alpha x_\beta + x_\gamma x_\delta);$$

and the last-mentioned six-valued function, (II. II.), will have its cube two-valued, if it be reducible to the form

$$\text{F} = \{a + b(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\alpha - x_\delta)(x_\beta - x_\gamma)(x_\beta - x_\delta)(x_\gamma - x_\delta)\}$$

$$\times \{x_\alpha x_\beta + x_\gamma x_\delta + \rho_3^2(x_\alpha x_\gamma + x_\beta x_\delta) + \rho_3(x_\alpha x_\delta + x_\beta x_\gamma)\},$$

ρ_3 being still an imaginary cube-root of unity. And the square of the two-valued function (II. III.) will be symmetric, if it be of the form

$$\text{F} = b(x_\alpha - x_\beta)(x_\alpha - x_\gamma)(x_\alpha - x_\delta)(x_\beta - x_\gamma)(x_\beta - x_\delta)(x_\gamma - x_\delta).$$

But there exists no other case of reduction essentially distinct from these, in which the number of values of the square or cube of a rational function of four independent variables is less than the number of values of that function itself. Some steps, indeed, have been for brevity omitted, which would be requisite for the full statement of a formal demonstration of all the foregoing theorems; but these omitted steps will easily occur to any one, who has considered with attention the investigation of the properties of rational functions of three variables, given in the two preceding articles.

[20.] The foregoing theorems respecting functions of four variables being admitted, let us now proceed to apply them to the *à priori* investigation of all possible expressions, finite and irreducible, of the form $b^{(m)}$, for a root x of the general biquadratic equation already often referred to, namely,

$$x^4 + a_1 x^3 + a_2 x^2 + a_3 x + a_4 = 0.$$

It is evident in the first place that we cannot express any such root x as a rational function of the coefficients a_1, a_2, a_3, a_4, because these are symmetric relatively to the four roots x_1, x_2, x_3, x_4, and a symmetric function of four arbitrary and independent quantities cannot be equal to an unsymmetric function of them; we must therefore suppose that m in $b^{(m)}$ is greater than 0, or, in other

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words, that the function $b^{(m)}$ is irrational, with respect to the quantities a_1, a_2, a_3, a_4, if any expression of the required kind can be found at all for x. On the other hand, the general theorem of ABEL shows that if any such expression $b^{(m)}$ exist, it must be composed of some finite combination of quadratic and cubic radicals, together with rational functions; because 2 and 3 are the only prime divisors of the product $24 = 1.2.3.4$. And the first and only radical of the first order in $b^{(m)}$, must be a square-root, of the form

$$a_1' = b\,(x_1 - x_2)\,(x_1 - x_3)\,(x_1 - x_4)\,(x_2 - x_3)\,(x_2 - x_4)\,(x_3 - x_4)$$
$$= \sqrt{-442368 \cdot b^2 \cdot (e_1^2 - e_2^3)} = \sqrt{-2^{14} \cdot 3^3 \cdot b^2 \cdot (e_1^2 - e_2^3)},$$

b being some symmetric function of x_1, x_2, x_3, x_4, and e_1, e_2 having the same meanings here as in the second article; because no rational and unsymmetric function of four arbitrary quantities x_1, x_2, x_3, x_4, has a prime power symmetric, except either this function a_1', or else some other such as a_2' which may be deduced from it by a multiplication such as the following, $a_2' = \frac{c}{b} a_1'$. But a two-valued expression of the form $f_1' = b_0 + b_1 a_1'$ cannot represent a four-valued function, such as x; we must therefore suppose that the sought expression $b^{(m)}$ contains a radical a_1'' of the second order, and this must be a cube-root, of the form

$$a_1'' = (p_0 + p_1 a_1')\,(u_1 + \rho_3^2 u_2 + \rho_3 u_3) = \sqrt[3]{(b_0 + b_1 a_1')};$$

in which, ρ_3 is, as before, an imaginary cube-root of unity; p_0, p_1, b_0, b_1 are symmetric relatively to x_1, x_2, x_3, x_4, or rational relatively to a_1, a_2, a_3, a_4;

$$u_1 = x_1 x_2 + x_3 x_4, \quad u_2 = x_1 x_3 + x_2 x_4, \quad u_3 = x_1 x_4 + x_2 x_3;$$

and

$$b_0 + b_1 a_1' = 1728\,(p_0 + p_1 a_1')^3 \left\{ e_1 + \tfrac{1}{1152}(\rho_3^2 - \rho_3) \frac{a_1'}{b} \right\},$$

the rational function e_1, and the radical a_1' retaining their recent meanings: because no rational function r_1'' of four independent variables x_1, x_2, x_3, x_4, which cannot be reduced to the form thus assigned for a_1'', can have itself $2\,a_1''$ values, a_1'' being a prime number greater than 1, if the number of values of the prime power $r_1''^{a_1''}$ be only 2. Nor can any other radical

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such as a_2'' of the same order enter into the expression of the irreducible function $b^{(m)}$; because this other radical would be obliged to be of one or other of the two forms following, namely either

$$a_2'' = (q_0 + q_1 a_1')(u_1 + \rho_3^2 u_2 + \rho_3 u_3),$$

or else

$$a_2'' = (q_0 + q_1 a_1')(u_1 + \rho_3 u_2 + \rho_3^2 u_3),$$

ρ_3 being the same cube-root of unity in these expressions, as in the expression for a_1''; and the product of the two last trinomial factors is symmetric,

$$(u_1 + \rho_3^2 u_2 + \rho_3 u_3)(u_1 + \rho_3 u_2 + \rho_3^2 u_3) = 144\, e_2;$$

so that either the quotient $\frac{a_2''}{a_1''}$ or the product $a_2''\ a_1''$ would be a two-valued function, which would be known when a_1' had been calculated, without any new extraction of radicals. At the same time, if we observe that

$$u_1 + u_2 + u_3 = a_2,$$

we see that the three values u_1, u_2, u_3 of the three-valued function $x_\alpha x_\beta + x_\gamma x_\delta$ can be expressed as rational functions of the radicals a_1'' and a_1', or as irrational functions of the second order of the coefficients a_1, a_2, a_3, a_4 of the proposed biquadratic equation, namely the following,

$$u_1 = \tfrac{1}{5}\left\{a_2 + \frac{a_1''}{p_0 + p_1 a_1'} + \frac{144\, e_2 (p_0 + p_1 a_1')}{a_1''}\right\},$$

$$u_2 = \tfrac{1}{5}\left\{a_2 + \frac{\rho_3 a_1''}{p_0 + p_1 a_1'} + \frac{144\, e_2 (p_0 + p_1 a_1')}{\rho_3 a_1''}\right\},$$

$$u_3 = \tfrac{1}{5}\left\{a_2 + \frac{\rho_3^2 a_1''}{p_0 + p_1 a_1'} + \frac{144\, e_2 (p_0 + p_1 a_1')}{\rho_3^2 a_1''}\right\};$$

so that if the biquadratic equation can be resolved at all, by any finite combination of radicals and rational functions, the solution must begin by calculating a square-root a_1' and a cube-root a_1'', which are in all essential respects the same as those required for resolving that other equation of which u_1, u_2, u_3 are roots, namely the following cubic equation:

$$u^3 - a_2 u^2 + (a_1 a_3 - 4 a_4) u + (4 a_2 - a_1^2) a_4 - a_3^2 = 0;$$

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which may also be thus written,

$$(u - \tfrac{1}{3}a_2)^3 - 48\,e_2\,(u - \tfrac{1}{3}a_2) - 128\,e_1 = 0.$$

Reciprocally if u_1, u_2, u_3 be known, by the solution of this cubic equation, or in any other way, we can calculate a_1' and a_1'', without any new extraction of radicals; since if we put, for abridgment,

$$t_1 = u_2 - u_3 = (x_1 - x_2)(x_3 - x_4),$$
$$t_2 = u_1 - u_3 = (x_1 - x_3)(x_2 - x_4),$$
$$t_3 = u_1 - u_2 = (x_1 - x_4)(x_2 - x_3),$$

we have

$$a_1' = b\,t_1\,t_2\,t_3,$$

and

$$a_1'' = (p_0 + p_1\,b\,t_1\,t_2\,t_3)(u_1 + \rho_3^2\,u_2 + \rho_3\,u_3).$$

Again, it is important to observe, that if any one of the three quantities t_1, t_2, t_3, such as t_1, be given, the other two, t_2, t_3, and also u_1, u_2, u_3, can be deduced from it, without any new extraction; because, in general, the difference of any two roots of a cubic equation is sufficient to determine rationally all the three roots of that equation: it must therefore be possible to express the radicals a_1' and a_1'' as rational functions of t_1; and accordingly we find

$$a_1' = b\,t_1\,(144\,e_2 - t_1^2),$$

and

$$a_1'' = \left\{p_0 + p_1\,b\,t_1\,(144\,e_2 - t_1^2)\right\}\left(\frac{\rho_3^2 - \rho_3}{2}\,t_1 + \frac{576\,e_1}{48\,e_2 - t_1^2}\right);$$

while t_1 may reciprocally be expressed as follows,

$$t_1 = u_2 - u_3 = \tfrac{1}{3}(\rho_3 - \rho_3^2)\left\{\frac{a_1''}{p_0 + p_1\,a_1'} - \frac{144\,e_2\,(p_0 + p_1\,a_1')}{a_1''}\right\}.$$

Hence the most general irrational function of the second order,

$$f_1'' = b_0' + b_1'\,a_1'' + b_2'\,a_1''^2,$$

which can enter into the composition of $b^{(m)}$, and in which b_0', b_1', b_2' are functions of the first order, and of the forms

$$(b_0')_0 + (b_0')_1\,a_1', \quad (b_1')_0 + (b_1')_1\,a_1', \quad (b_2')_0 + (b_2')_1\,a_1',$$

may be considered as a rational function of t_1,

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$$f_1'' = \phi(t_1) = \phi(\overline{x_1 - x_2} \cdot \overline{x_3 - x_4});$$

it is, therefore, included under the form (II. II.), and is either six-valued or three-valued, according as it does not, or as it does reduce itself to a rational function of u_1, by becoming a rational function of t_1^2; and in neither case can it become a four-valued function such as x. We must therefore suppose, that the sought irrational expression $b^{(m)}$, for a root x of the general biquadratic, contains at least one radical a_1''' of the third order, which, relatively to the coefficients a_1, a_2, a_3, a_4, must be a square-root, (and not a cube-root,) of the form

$$a_1''' = \sqrt{b_0' + b_1' a_1'' + b_2' a_1''^2};$$

and, relatively to the roots x_1, x_2, x_3, x_4, must admit of being expressed either as a twelve-valued function, with a six-valued square, which square is of the form (II. II.); or else as a six-valued function, which is not itself of that form (II. II.), and of which the square is three-valued. This radical a_1''' must therefore admit of being put under the form

$$a_1''' = b_\alpha'' v_\alpha,$$

the factor b_α'' being a function of the second or of a lower order, and v_α being one or other of the three following functions,

$$v_1 = x_1 + x_2 - x_3 - x_4, \quad v_2 = x_1 + x_3 - x_2 - x_4, \quad v_3 = x_1 + x_4 - x_2 - x_3,$$

which are themselves six-valued, but have three-valued squares. And since the product of the three functions v_α is symmetric,

$$v_1 v_2 v_3 = 64 \cdot e_4,$$

(e_4 having here the same meaning as in the second article,) we need only consider, at most, two radicals of the third order,

$$a_1''' = b_1'' v_1 = \sqrt{b_1''^3 (a_1^2 - 4a_4 + 4u_1)}, \quad a_2''' = b_2'' v_2 = \sqrt{b_2''^3 (a_1^2 - 4a_4 + 4u_2)};$$

and may express the most general irrational function of the third order, which can enter into the composition of $b^{(m)}$, as follows:

$$f_1''' = b_{0,0}'' + b_{1,0}'' a_1''' + b_{0,1}'' a_2''' + b_{1,1}'' a_1''' a_2''';$$

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the coefficients of this expression being functions of the second or of lower orders. If we suppress entirely one of the two last radicals, such as a_2''', without introducing any higher radical a_1^{IV}, we shall indeed obtain a simplified expression, but cannot thereby represent any root, such as x_α, of the proposed biquadratic equation; for if we could do this, we should then have a system of two expressions for two different roots, x_α, x_β, of the forms

$$x_\alpha = b_0'' + b_1'' a_1''', \quad x_\beta = b_0'' - b_1'' a_1''',$$

which would give

$$b_0'' = \tfrac{1}{2}(x_\alpha + x_\beta);$$

but this last rational function, although six-valued, cannot be put under the form (II. II.), and therefore cannot be equal to any function of the second order, such as b_0''. Retaining therefore both the radicals, a_1''', a_2''', we have next to observe, that if the function f_1''' can coincide with the sought function $b^{(m)}$, so as to represent some one root x_α of the proposed biquadratic equation, it must give a system of expressions for all the four roots x_α, x_β, x_γ, x_δ, in some arrangement or other, by merely changing the signs of those two radicals of the third order; namely the following system,

$$\begin{aligned}
x_\alpha &= b_{0,0}'' + b_{1,0}'' a_1''' + b_{0,1}'' a_2''' + b_{1,1}'' a_1''' a_2''', \\
x_\beta &= b_{0,0}'' + b_{1,0}'' a_1''' - b_{0,1}'' a_2''' - b_{1,1}'' a_1''' a_2''', \\
x_\gamma &= b_{0,0}'' - b_{1,0}'' a_1''' + b_{0,1}'' a_2''' - b_{1,1}'' a_1''' a_2''', \\
x_\delta &= b_{0,0}'' - b_{1,0}'' a_1''' - b_{0,1}'' a_2''' + b_{1,1}'' a_1''' a_2''';
\end{aligned}$$

which four expressions for the four roots conduct to the four following relations,

$$\begin{aligned}
b_{0,0}'' &= \tfrac{1}{4}(x_\alpha + x_\beta + x_\gamma + x_\delta), \\
b_{1,0}'' a_1''' &= \tfrac{1}{4}(x_\alpha + x_\beta - x_\gamma - x_\delta), \\
b_{0,1}'' a_2''' &= \tfrac{1}{4}(x_\alpha - x_\beta + x_\gamma - x_\delta), \\
b_{1,1}'' a_1''' a_2''' &= \tfrac{1}{4}(x_\alpha - x_\beta - x_\gamma + x_\delta).
\end{aligned}$$

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Reciprocally, if these four last conditions can be satisfied, by any suitable arrangement of the four roots, and by any suitable choice of those coefficients or functions which have hitherto been left undetermined, we shall have the four expressions just now mentioned, for the four roots of the general biquadratic, as the four values of an irrational and irreducible function b''', of the third order. Now, these four conditions are satisfied when we suppose

$$x_\alpha = x_1, \quad x_\beta = x_2, \quad x_\gamma = x_3, \quad x_\delta = x_4 ;$$

$$b''_{0,0} = \frac{-a_1}{4} ; \quad b''_{1,0} = \frac{1}{4\,b_1''} ; \quad b''_{0,1} = \frac{1}{4\,b_2''} ;$$

and finally

$$b''_{1,1} = \frac{16\,e_4}{b_1''\,b_2''\,v_1^{\,2}\,v_2^{\,2}} ;$$

but not by any suppositions essentially distinct from these. It is therefore possible to express the four roots of the general biquadratic equation, as the four values of an irrational and irreducible expression of the third order b''', namely as the following:

$$x_1 = b'''_{0,0} = \frac{-a_1}{4} + \frac{a_1'''}{4\,b_1''} + \frac{a_2'''}{4\,b_2''} + \frac{16\,b_1''\,b_2''\,e_4}{a_1'''\,a_2'''} ;$$

$$x_2 = b'''_{0,1} = \frac{-a_1}{4} + \frac{a_1'''}{4\,b_1''} - \frac{a_2'''}{4\,b_2''} - \frac{16\,b_1''\,b_2''\,e_4}{a_1'''\,a_2'''} ;$$

$$x_3 = b'''_{1,0} = \frac{-a_1}{4} - \frac{a_1'''}{4\,b_1''} + \frac{a_2'''}{4\,b_2''} - \frac{16\,b_1''\,b_2''\,e_4}{a_1'''\,a_2'''} ;$$

$$x_4 = b'''_{1,1} = \frac{-a_1}{4} - \frac{a_1'''}{4\,b_1''} - \frac{a_2'''}{4\,b_2''} + \frac{16\,b_1''\,b_2''\,e_4}{a_1'''\,a_2'''} ;$$

and there exists no system of expressions, essentially distinct from these, which can express the same four roots, without the introduction of some radical, such as a_1^{IV}, of an order higher than the third. We must, however, remember that these expressions involve several arbitrary symmetric functions of x_1, x_2, x_3, x_4, or arbitrary rational functions of a_1, a_2, a_3, a_4, which enter into the composition of the radicals a_1', a_1'', a_1''' a_2''', though only in the way of multiplying a function by an exact square or cube before the square-root or cube-root is extracted:

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namely, the quantity b in a_1'; p_0 and p_1 in a_1''; and, in the radicals a_1''', a_2''', twelve other arbitrary quantities, introduced by the functions b_1'', b_2'', which latter functions may be thus developed,

$$b_1'' = r_{0,0} + r_{0,1}\,a_1' + (r_{1,0} + r_{1,1}\,a_1')\,a_1'' + (r_{2,0} + r_{2,1}\,a_1')\,a_1''^2,$$
$$b_2'' = r`_{0,0} + r`_{0,1}\,a_1' + (r`_{1,0} + r`_{1,1}\,a_1')\,a_1'' + (r`_{2,0} + r`_{2,1}\,a_1')\,a_1''^2.$$

In the earlier articles of this Essay, these fifteen arbitrary quantities had the following particular values,

$$b = \frac{\rho_3^2 - \rho_3}{1152}; \quad p_0 = \frac{1}{12}; \quad p_1 = 0;$$
$$r_{0,0} = \tfrac{1}{4}; \quad r_{0,1} = r_{1,0} = r_{1,1} = r_{2,0} = r_{2,1} = 0;$$
$$r`_{0,0} = \tfrac{1}{4}; \quad r`_{0,1} = r`_{1,0} = r`_{2,1} = r`_{2,0} = r`_{2,1} = 0.$$

Apparent differences between two systems of expressions of the third order, for the four roots of a biquadratic equation, may also arise from differences in the arrangement of those four roots.

Analogous reasonings, the details of which will easily suggest themselves to those who have studied the foregoing discussion, show that if we retain only one radical of the third order a_1''', but introduce a radical of the fourth order a_1^{IV}, for the purpose of obtaining the only other sort of irrational and irreducible expression, $b^{(\pi)} = b^{IV}$, which can represent a root of the same general biquadratic equation, we must then suppose this new radical a_1^{IV} to be a square-root, of the form

$$a_1^{IV} = p'''(x_1 - x_2) = \sqrt{p'''^2\left(-\frac{v_1^2}{4} + 12e_3 + \frac{32e_4}{v_1}\right)};$$

p''' being a function of the third or of a lower order, which in the earlier articles of this Essay had the particular value $\frac{1}{2}$; while v_1 has the meaning recently assigned, and e_3, e_4 have those which were stated in the second article; we must also employ the expressions

$$x_1 = b_0''' + b_1'''\,a_1^{IV} = \frac{-a_1}{4} + \frac{v_1}{4} + \frac{a_1^{IV}}{2p'''},$$
$$x_2 = b_0''' - b_1'''\,a_1^{IV} = \frac{-a_1}{4} + \frac{v_1}{4} - \frac{a_1^{IV}}{2p'''},$$

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and

$$x_3 = \frac{-a_1}{4} - \frac{v_1}{4} + \frac{p''' t_1}{2 a_1^{IV}}, \quad x_4 = \frac{-a_1}{4} - \frac{v_1}{4} - \frac{p''' t_1}{2 a_1^{IV}},$$

t_1 retaining here its recent meaning; or, at least, we must make suppositions, and must employ expressions, not differing essentially from these.

But all the radicals, a_1', a_1'', a_1''', a_2''', a_1^{IV}, introduced in the present article, agree in all essential respects with those which have been long employed, for the calculation of the roots of the general biquadratic equation; it is, therefore, impossible to discover any new expression for any one of those four roots, which, after being cleared from all superfluous extractions of radicals, shall differ essentially, in the extractions that remain, from the expressions that have been long discovered. And the only important difference, with respect to these extractions of radicals, between any two general methods for resolving biquadratic equations, if both be free from all superfluous extractions, is, that after calculating first, in both methods, a square-root a_1', and a cube-root a_1'', (operations which are equivalent to those required for the solution of an auxiliary cubic equation,) we may afterwards either calculate two *simultaneous* square-roots a_1''', a_2''', as in the method of Euler, or else two *successive* square-roots a_1''', a_1^{IV}, as in the method of Ferrari or Des Cartes:—for, in the view in which they are here considered, the methods of these two last-mentioned mathematicians do not essentially differ from each other.

[21.] It is not necessary, for the purposes of the inquiry into the possibility or impossibility of representing, by any expression of the form $b^{(m)}$, a root x of the general equation of the fifth degree,

$$x^5 + a_1 x^4 + a_2 x^3 + a_3 x^2 + a_4 x + a_5 = 0,$$

to investigate all possible forms of rational functions of five variables, which have fewer than 120 values; but it is necessary to discover all those forms which have five or fewer values. Now, if the rational function

$$\mathrm{F}(x_1, x_2, x_3, x_4, x_5)$$

have fewer than six values, when the five arbitrary roots x_1, x_2, x_3, x_4, x_5, of the

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above-mentioned general equation are interchanged in all possible ways, it must, by still stronger reason, have fewer than six values, when only the first four roots, x_1, x_2, x_3, x_4, are interchanged in any manner, the fifth root x_5 remaining unchanged.

Hence, by the properties of functions of four variables, the function P must be reducible to one of the four following forms, corresponding to those which, in the nineteenth article, were marked (I. III.), (II. III.), (I. II.), and (I. I.):

$$(a) \ldots \phi(x_5);$$
$$(b) \ldots \phi(x_5, \overline{x_1-x_2} \cdot \overline{x_1-x_3} \cdot \overline{x_1-x_4} \cdot \overline{x_2-x_3} \cdot \overline{x_2-x_4} \cdot \overline{x_3-x_4});$$
$$(c) \ldots \phi(x_5, x_1x_2+x_3x_4);$$
$$(d) \ldots \phi(x_5, x_4);$$

or at least to some form not essentially distinct from these. In making this reduction, the principle is employed, that any symmetric function of x_1, x_2, x_3, x_4, is a rational function of x_5, and of the five coefficients a_1, a_2, a_3, a_4, a_5; which latter coefficients are tacitly supposed to be capable of entering in any manner into the rational functions ϕ.

It may also be useful to remark, before going farther, that the four forms here referred to, of functions of four variables, with four or fewer values, may be deduced anew as follows. Retaining the abridged notation $(\alpha, \beta, \gamma, \delta)$, we see immediately that if the six syntypical functions

$$(1, 2, 3, 4), \ (2, 3, 1, 4), \ (3, 1, 2, 4), \ (1, 3, 2, 4), \ (3, 2, 1, 4), \ (2, 1, 3, 4)$$

be not all unequal among themselves, they must either all be equal, in which case we have the four-valued form $\phi(x_1)$ or (I. I.), or else must distribute themselves into two distinct groups of three, or into three distinct groups of two equal functions. But if we suppose $(1, 2, 3, 4) = (2, 3, 1, 4) = (3, 1, 2, 4)$, in order to get the reduction to two groups, the functions $(1, 2, 3, 4)$ and $(2, 1, 3, 4)$ being not yet supposed to be equal; and then require that the six following values of $(\alpha, \beta, \gamma, \delta)$,

$$(1, 2, 3, 4), \ (2, 1, 3, 4), \ (1, 2, 4, 3), \ (2, 1, 4, 3), \ (1, 3, 4, 2), \ (3, 1, 4, 2),$$

shall not be all unequal; we must either make some supposition, such as $(1, 2, 3, 4) = (1, 2, 4, 3)$, which conducts to the one-valued form (I. III.), or else must make some supposition, such as $(1, 2, 3, 4) = (2, 1, 4, 3)$, which conducts to the

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two-valued form (II. III.). And if we suppose (1, 2, 3, 4) = (2, 1, 3, 4), in order to reduce the six functions (1, 2, 3, 4) . . . (2, 1, 3, 4) to three distinct groups, the functions (1, 2, 3, 4) and (2, 3, 1, 4) being supposed unequal; and then require that of the six following values,

(1, 2, 3, 4), (2, 3, 1, 4), (3, 1, 2, 4), (1, 2, 4, 3), (2, 4, 1, 3), (4, 1, 2, 3),

there shall be fewer than five unequal; we must either suppose (2, 3, 1, 4) = (4, 1, 2, 3), in which case we are conducted to the three-valued form (I. II.); or else must suppose (2, 3, 1, 4) = (2, 4, 1, 3), which conducts again to the four-valued function (I. I.), by giving (1, 2, 3, 4) = $\phi(x_3)$.

Now of the four forms (a), (b), (c), (d), the form (a) is five-valued, and therefore admissible in the present inquiry; but the form (b) is, in general, ten-valued; the form (c) has, in general, fifteen values; and the form (d) has twenty. If, then, we are to reduce the functions (b) (c) (d) within that limit of number of values to which we are at present confining ourselves, we must restrict them by some new conditions, of which the following are sufficient types:

$$(b)' \ldots \phi(x_5, \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_4}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_3-x_4}) = \phi(x_5, -\overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_4}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_3-x_4});$$

$$(b)'' \ldots \phi(x_5, \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_4}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_3-x_4}) = \phi(x_4, \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_5}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_5}\,.\,\overline{x_3-x_5});$$

$$(b)''' \ldots \phi(x_5, \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_4}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_3-x_4}) = \phi(x_4, -\overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_5}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_5}\,.\,\overline{x_3-x_5});$$

$$(c)' \ldots \phi(x_5, x_1x_2 + x_3x_4) = \phi(x_5, x_1x_3 + x_2x_4);$$

$$(c)'' \ldots \phi(x_5, x_1x_2 + x_3x_4) = \phi(x_4, x_1x_2 + x_3x_5);$$

$$(c)''' \ldots \phi(x_5, x_1x_2 + x_3x_4) = \phi(x_4, x_1x_3 + x_2x_5);$$

$$(d)' \ldots \phi(x_5, x_4) = \phi(x_5, x_3);$$

$$(d)'' \ldots \phi(x_5, x_4) = \phi(x_4, x_3);$$

$$(d)''' \ldots \phi(x_5, x_4) = \phi(x_2, x_3).$$

(To suppose $\phi(x_5, x_4) = \phi(x_4, x_5)$, would indeed reduce the number of values of the function (d) from twenty to ten, but a new reduction would be required,

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in order to depress that number below six, and thus we should still be obliged to employ one of the three conditions (d)′ (d)″ (d)‴.) Of these twelve different conditions (b)′ . . (d)‴, some one of which we must employ, (or at least some condition not essentially different from it,) the three marked (b)′ (c)′ (d)′ are easily seen to reduce respectively the three functions (b) (c) (d) to the five-valued form (a); they are therefore admissible, but they give no new information. The supposition (b)″ conducts us to equate the function (b) to the following,

$$\phi(x_3,\ \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_4}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_3-x_4}),$$

because it allows us to interchange x_3 and x_3, inasmuch as x_3 may previously be put in the place of x_4, and x_4 in the place of x_3, by interchanging at the same time x_1 and x_2,—a double interchange which does not alter the product $\overline{x_1-x_2}\ldots\overline{x_3-x_4}$, since it only changes simultaneously the signs of the two factors x_1-x_2 and x_3-x_4; or because, if we denote the function (b) by the symbol (1, 2, 3, 4, 5), we have (1, 2, 3, 4, 5) = (2, 1, 4, 3, 5), and also, by (b)″, (1, 2, 3, 4, 5) = (1, 2, 3, 5, 4), so that we must have (1, 2, 3, 4, 5) = (2, 1, 4, 5, 3) = (1, 2, 5, 4, 3); but also the condition (b)‴ gives (1, 2, 5, 4, 3) = (1, 2, 5, 3, 4); we must therefore suppose (1, 2, 3, 5, 4) = (1, 2, 5, 3, 4), that is,

$$\begin{aligned}&\phi(x_4,\ \overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_5}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_5}\,.\,\overline{x_3-x_5})\\ =\ &\phi(x_4,\ -\overline{x_1-x_2}\,.\,\overline{x_1-x_3}\,.\,\overline{x_1-x_5}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_5}\,.\,\overline{x_3-x_5}),\end{aligned}$$

which is an equation of the form (b)′, and reduces the function (b) to the form (a), and ultimately to a symmetric function a, because x_3 and x_4 may be interchanged. The supposition (b)‴ conducts to a two-valued function, which changes value when any two of the five roots are interchanged, so that the sum (1, 2, 3, 4, 5) + (1, 2, 3, 5, 4), and the quotient

$$\frac{(1,2,3,4,5)-(1,2,3,5,4)}{\overline{(x_1-x_2)(x_1-x_3)\ldots(x_4-x_5)}},$$

are some symmetric functions, which may be called $2a$ and $2b$; we have therefore, in this case, a function of the form,

$$(e)\ldots a+b\,\overline{x_1-x_2}\,.\,\overline{x_1-x_6}\,.\,\overline{x_1-x_4}\,.\,\overline{x_1-x_5}\,.\,\overline{x_2-x_3}\,.\,\overline{x_2-x_4}\,.\,\overline{x_2-x_6}\,.\,\overline{x_3-x_4}\,.\,\overline{x_3-x_6}\,.\,\overline{x_4-x_5},$$

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in which a and b are symmetric. The remaining suppositions, (c)", (c)"', (d)", (d)"', are easily seen to conduct only to symmetric functions; for instance, (c)" gives

$$\phi(x_5, x_1 x_2 + x_3 x_4) = \phi(x_4, x_3 x_5 + x_2 x_1) = \phi(x_1, x_3 x_5 + x_2 x_4)$$
$$= \phi(x_1, x_2 x_4 + x_3 x_5) = \phi(x_5, x_2 x_4 + x_3 x_1) = \phi(x_3, x_1 x_3 + x_2 x_4),$$

so that the condition (c)' is satisfied, and at the same time x_5 is interchangeable with x_4. And it is easy to see that the five-valued function $\phi(x_a)$ may be put under the form

$$(f) \ldots b_0 + b_1 x_a + b_2 x_a^2 + b_3 x_a^3 + b_4 x_a^4;$$

the coefficients $b_0\, b_1\, b_2\, b_3\, b_4$ being symmetric. It is clear also that neither this five-valued function (f), nor the two-valued function (e), admits of any reduction in respect to number of values, without becoming altogether symmetric. There are, therefore, no unsymmetric and rational functions of five independent variables, with fewer than six values, except only the two-valued function (e), and the five-valued function (f).

Suppose now that we have the equation

$$a_1' = \mathrm{F}_1'(x_1, x_2, x_3, x_4, x_5),$$

F_1' being a rational but unsymmetric function; and that

$$a_1'^{a_1'} = f_1(a_1, a_2, a_3, a_4, a_5),$$

the exponent a_1' being prime, and the function f_1 being rational relatively to $a_1, \ldots a_5$, and therefore symmetric relatively to $x_1, \ldots x_5$. With these suppositions, the function F_1' must, by the principles of a former artiele, have exactly a_1' values, corresponding to changes of arrangement of the five arbitrary quanties $x_1, \ldots x_5$; the exponent a_1' must therefore be a prime divisor of the product $120 (= 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5)$; that is, it must be 2, or 3, or 5. But we have seen that no rational function of five variables has exactly three values; and if we supposed it to have five values, so as to put, (by what has been already shown,)

$$a_1' = b_0 + b_1 x_a + b_2 x_a^2 + b_3 x_a^3 + b_4 x_a^4,$$

we should then have three other equations of the forms

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$$a_1'^2 = b_0^{(2)} + b_1^{(2)} x_\alpha + b_2^{(2)} x_\alpha^2 + b_3^{(2)} x_\alpha^3 + b_4^{(2)} x_\alpha^4,$$
$$a_1'^3 = b_0^{(3)} + b_1^{(3)} x_\alpha + b_2^{(3)} x_\alpha^2 + b_3^{(3)} x_\alpha^3 + b_4^{(3)} x_\alpha^4,$$
$$a_1'^4 = b_0^{(4)} + b_1^{(4)} x_\alpha + b_2^{(4)} x_\alpha^2 + b_3^{(4)} x_\alpha^3 + b_4^{(4)} x_\alpha^4,$$

the coefficients being all symmetric, and being determined through the elimination of all higher powers of x_α than the fourth, by means of the equations

$$x_\alpha^5 + a_1 x_\alpha^4 + a_2 x_\alpha^3 + a_3 x_\alpha^2 + a_4 x_\alpha + a_5 = 0,$$
$$x_\alpha^6 + a_1 x_\alpha^5 + a_2 x_\alpha^4 + a_3 x_\alpha^3 + a_4 x_\alpha^2 + a_5 x_\alpha = 0, \text{ \&c.};$$

and it would always be possible to find symmetric multipliers c_1, c_2, c_3, c_4, which would not all be equal to 0, and would be such that

$$c_1 b_2 + c_2 b_2^{(2)} + c_3 b_2^{(3)} + c_4 b_2^{(4)} = 0,$$
$$c_1 b_3 + c_2 b_3^{(2)} + c_3 b_3^{(3)} + c_4 b_3^{(4)} = 0,$$
$$c_1 b_4 + c_2 b_4^{(2)} + c_3 b_4^{(3)} + c_4 b_4^{(4)} = 0;$$

in this manner then we should obtain an equation of the form

$$c_1 a_1' + c_2 a_1'^2 + c_3 a_1'^3 + c_4 a_1'^4 =$$
$$c_1 b_0 + c_2 b_0^{(2)} + c_3 b_0^{(3)} + c_4 b_0^{(4)} + (c_1 b_1 + c_2 b_1^{(2)} + c_3 b_1^{(3)} + c_4 b_1^{(4)}) x_\alpha,$$

in which it would be impossible that the coefficient of x_α should vanish, because the five unequal values of a_1' could not all satisfy one common equation, of the fourth or of a lower degree; we should therefore have an expression for x_α of the form

$$x_\alpha = d_0 + d_1 a_1' + d_2 a_1'^2 + d_3 a_1'^3 + d_4 a_1'^4,$$

the coefficients $d_0, \ldots d_4$ being symmetric; and for the same reason we should have also

$$x_\beta = d_0 + d_1 \rho_5 a_1' + d_2 \rho_5^2 a_1'^2 + d_3 \rho_5^3 a_1'^3 + d_4 \rho_5^4 a_1'^4,$$
$$x_\gamma = d_0 + d_1 \rho_5^2 a_1' + d_2 \rho_5^4 a_1'^2 + d_3 \rho_5 a_1'^3 + d_4 \rho_5^3 a_1'^4,$$
$$x_\delta = d_0 + d_1 \rho_5^3 a_1' + d_2 \rho_5 a_1'^2 + d_3 \rho_5^4 a_1'^3 + d_4 \rho_5^2 a_1'^4,$$
$$x_\epsilon = d_0 + d_1 \rho_5^4 a_1' + d_2 \rho_5^3 a_1'^2 + d_3 \rho_5^2 a_1'^3 + d_4 \rho_5 a_1'^4,$$

x_α, x_β, x_γ, x_δ, x_ϵ denoting, in some arrangement or other, the five roots x_1, x_2,

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x_3, x_4, x_5, and ρ_5, ρ_5^2, ρ_5^3, ρ_5^4 being the four imaginary fifth-roots of unity; consequently we should have

$$5\,d_1\,a_1' = x_\alpha + \rho_5^4\,x_\beta + \rho_5^3\,x_\gamma + \rho_5^2\,x_\delta + \rho_5\,x_\epsilon\,;$$

a result which is absurd, the second member of the equation having 120 values, while the first member has only five. We must therefore suppose that the exponent a_1' is $= 2$, and consequently must adopt the expression

$$a_1' = b\,(x_1-x_2)\,(x_1-x_3)\,(x_1-x_4)\,(x_1-x_5)\,(x_2-x_3)\,(x_2-x_4)\,(x_2-x_5)\,(x_3-x_4)\,(x_3-x_5)\,(x_4-x_5),$$

the factor b being symmetric. This, therefore, is the only rational and unsymmetric function of five arbitrary quantities, which has a prime power (namely its square) symmetric.

Let us next inquire whether it be possible to find any unsymmetric but rational function,

$$a_1'' = \mathrm{F}_1''\,(x_1,\ x_2,\ x_3,\ x_4,\ x_5),$$

which, having itself more than two values, shall have a prime power two-valued,

$$a_1''^{\,a_1''} = f_1' = a + b\,(x_1-x_2)\ldots(x_4-x_5).$$

If so, the function F_1'' must have exactly $2a_1''$ values, and consequently the prime exponent a_1'' must be either three or five, because it must be a divisor of 120, and cannot be $= 2$, since no rational function of five arbitrary quantities has exactly four values: so that a_1'' or F_1'' must be either a cube-root or a fifth-root of the two-valued function f_1'. And the six or ten values of F_1'' must admit of being expressed as follows:

$$(1,\ 2,\ 3,\ 4,\ 5)_i\,;\quad \rho_{a_1''}(1,\ 2,\ 3,\ 4,\ 5)_i\,;\ \ldots\ \rho_{a_1''}^{a_1''-1}(1,\ 2,\ 3,\ 4,\ 5)_i\,;$$

$$(1,\ 2,\ 3,\ 4,\ 5)_k\,;\quad \grave{\rho}_{a_1''}(1,\ 2,\ 3,\ 4,\ 5)_k\,;\ \ldots\ \grave{\rho}_{a_1''}^{a_1''-1}(1,\ 2,\ 3,\ 4,\ 5)_k\,;$$

in which, $\rho_{a_1''}$ and $\grave{\rho}_{a_1''}$ are imaginary cube-roots or fifth-roots of unity, according as a_1'' is 3 or 5; while $(1,\ 2,\ 3,\ 4,\ 5)_i$ and $(1,\ 2,\ 3,\ 4,\ 5)_k$ are some two different values of the function F_1'', which may be called F_1'' and $\mathrm{F}_1^{\vee\prime}$, and correspond to different arrangements of x_1, x_2, x_3, x_4, x_5, being also such that

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$$\mathrm{F}_i''^{a_i''} = (1, 2, 3, 4, 5)_i^{a_i''} = a + b(x_1 - x_2) \ldots (x_4 - x_5),$$

$$\mathrm{F}_i'''^{a_i''} = (1, 2, 3, 4, 5)_k^{a_i''} = a - b(x_1 - x_2) \ldots (x_4 - x_5).$$

These last equations show that the cube or fifth power (according as a_i'' is 3 or 5) of the product of $(1, 2, 3, 4, 5)_i$ and $(1, 2, 3, 4, 5)_k$ is symmetric, and consequently, by what was lately proved, that this product itself is symmetric; so that we may write

$$\mathrm{F}_i'' \cdot \mathrm{F}_i''' = (1, 2, 3, 4, 5)_i \cdot (1, 2, 3, 4, 5)_k = c,$$

and therefore

$$\nabla(1, 2, 3, 4, 5)_i \cdot \nabla(1, 2, 3, 4, 5)_k = c,$$

∇ being here the characteristic of any arbitrary change of arrangement of the five roots, which change, however, is to operate similarly on the two functions to which the symbol is prefixed. (For example, if we suppose

$$(1, 2, 3, 4, 5)_i = (1, 2, 3, 5, 4), \quad (1, 2, 3, 4, 5)_k = (1, 2, 4, 3, 5),$$

and if we employ ∇ to indicate that change which consists in altering the first to the second, the second to the third, the third to the fourth, the fourth to the fifth, and the fifth to the first of the five roots in any one arrangement, we shall have, in the present notation,

$$\nabla(1, 2, 3, 4, 5)_i = (2, 3, 5, 4, 1), \quad \nabla(1, 2, 3, 4, 5)_k = (2, 4, 3, 5, 1);$$

and similarly in other cases.) Supposing then that ∇ denotes the change of arrangement of the five roots which is made in passing from that value of the function F_i'' which is $= (1, 2, 3, 4, 5)_i$ to that other value of the same function which is $= \rho_{a_i''}(1, 2, 3, 4, 5)_i$, we see that the same change performed on $(1, 2, 3, 4, 5)_k$ must multiply this latter value not by $\rho_{a_i''}$ but by $\rho_{a_i''}^{-1}$; which factor is, however, of the form $\rho_{a_i''}^{\backprime}$, so that we may denote the $2\,a_i''$ values of F_i'' as follows:

$$(1, 2, 3, 4, 5)_i; \quad \nabla(1, 2, 3, 4, 5)_i; \ldots \nabla^{a_i''-1}(1, 2, 3, 4, 5)_i;$$

$$(1, 2, 3, 4, 5)_k; \quad \nabla(1, 2, 3, 4, 5)_k; \ldots \nabla^{a_i''-1}(1, 2, 3, 4, 5)_k.$$

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We see, at the same time, that the sum of the two functions $(1, 2, 3, 4, 5)_i$ and $(1, 2, 3, 4, 5)_k$ admits of *at least* α_1'' different values, namely,

$$\nabla^0\{(1, 2, 3, 4, 5)_i + (1, 2, 3, 4, 5)_k\} = \mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime},$$

$$\nabla^1\{(1, 2, 3, 4, 5)_i + (1, 2, 3, 4, 5)_k\} = \rho_{\alpha_1''}\,\mathrm{F}_1'' + \rho_{\alpha_1''}^{-1}\,\mathrm{F}_1^{\vee\prime},$$

$$\cdots\cdots\cdots\cdots$$

$$\nabla^{\alpha_1''-1}\{(1, 2, 3, 4, 5)_i + (1, 2, 3, 4, 5)_k\} = \rho_{\alpha_1''}^{\alpha_1''-1}\,\mathrm{F}_1'' + \rho_{\alpha_1''}^{-(\alpha_1''-1)}\,\mathrm{F}_1^{\vee\prime}.$$

On the other hand, this sum $\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime}$ cannot admit of *more* than α_1'' values, because it must satisfy an equation of the degree α_1'', with symmetric coefficients; which results from the two relations

$$\mathrm{F}_1''^{\alpha_1''} + \mathrm{F}_1^{\vee\prime\alpha_1''} = 2a, \quad \mathrm{F}_1''\,\mathrm{F}_1^{\vee\prime} = c,$$

and is either the cubic equation

$$(\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime})^3 - 3c\,(\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime}) - 2a = 0,$$

or the equation of the fifth degree

$$(\mathrm{F}_1'' + \mathrm{F}^{\vee\prime})^5 - 5c\,(\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime})^3 + 5c^2(\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime}) - 2a = 0,$$

according as α_1'' is 3 or 5. We must therefore suppose that the function $\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime}$ has *exactly* α_1'' values, and consequently that α_1'' is 5 and not 3, because no rational function of five independent variables has exactly three values. And from the form and properties of the only five-valued function of five variables, we must suppose farther, that

$$\mathrm{F}_1'' + \mathrm{F}_1^{\vee\prime} = \mathrm{F}_1'' + \frac{c}{\mathrm{F}_1''} = b_0 + b_1 x_\alpha + b_2 x_\alpha^2 + b_3 x_\alpha^3 + b_4 x_\alpha^4,$$

x_α being some one of the five roots $x_1, \ldots x_5$, and the coefficients $b_0, \ldots b_4$ being symmetric; and that conversely the root x_α may be thus expressed,

$$x_\alpha = d_0 + d_1\left(\mathrm{F}_1'' + \frac{c}{\mathrm{F}_1''}\right) + d_2\left(\mathrm{F}_1'' + \frac{c}{\mathrm{F}_1''}\right)^2 + \ldots + d_4\left(\mathrm{F}_1'' + \frac{c}{\mathrm{F}_1''}\right)^4,$$

the coefficients $d_0, \ldots d_4$ being symmetric. We must also suppose that by changing F_1'', successively, to $\rho_5\,\mathrm{F}_1''$, $\rho_5^2\,\mathrm{F}_1''$, $\rho_5^3\,\mathrm{F}_1''$, $\rho_5^4\,\mathrm{F}_1''$, we shall obtain successively, expressions for the other four roots, x_β, x_γ, x_δ, x_ϵ, in some arrangement

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or other; and therefore, if we observe that $F_1^{\prime\prime 5}$ has been concluded to be a function of the two-valued form, we find ourselves obliged to suppose that the five roots may be expressed as follows, (if the supposition under inquiry be correct,)

$$x_\alpha = e_0' + e_1' F_1'' + e_2' F_1''^2 + e_3' F_1''^3 + e_4' F_1''^4,$$
$$x_\beta = e_0' + \rho_5 e_1' F_1'' + \rho_5^2 e_2' F_1''^2 + \rho_5^3 e_3' F_1''^3 + \rho_5^4 e_4' F_1''^4,$$
$$x_\gamma = e_0' + \rho_5^2 e_1' F_1'' + \rho_5^4 e_2' F_1''^2 + \rho_5 e_3' F_1''^3 + \rho_5^3 e_4' F_1''^4,$$
$$x_\delta = e_0' + \rho_5^3 e_1' F_1'' + \rho_5 e_2' F_1''^2 + \rho_5^4 e_3' F_1''^3 + \rho_5^2 e_4' F_1''^4,$$
$$x_\varepsilon = e_0' + \rho_5^4 e_1' F_1'' + \rho_5^3 e_2' F_1''^2 + \rho_5^2 e_3' F_1''^3 + \rho_5 e_4' F_1''^4,$$

$e_0', \ldots e_5'$ being either symmetric or two-valued; but these expressions conduct to the absurd result,

$$5\, e_1' F_1'' = x_\alpha + \rho_5^4 x_\beta + \rho_5^3 x_\gamma + \rho_5^2 x_\delta + \rho_5 x_\varepsilon,$$

in which the first member has only ten, while the second member has 120 values. We are therefore obliged to reject as inadmissible the supposition

$$F_1''^{m,n} = f_1'';$$

and we find that no rational function of five arbitrary variables can have any prime power two-valued, if its own values be more numerous than two.

[22.] There is now no difficulty in proving, after the manner of ABEL, that it is impossible to represent a root of the general equation of the fifth degree, as a function of the coefficients of that equation, by any expression of the form $b^{(m)}$; that is, by any finite combination of radicals and rational functions.

For, in the first place, since the coefficients $a_1, \ldots a_5$ are symmetric functions of the roots $x_1, \ldots x_5$, it is clear that we cannot express any one of the latter as a rational function of the former; m in $b^{(m)}$, must therefore be greater than 0; and the expression $b^{(m)}$ if it exist at all, must involve at least one radical of the first order, a_1', which must admit of being expressed as a rational but unsymmetric function F_1' of the five roots, but must have a prime power $F_1'^{m'}$ symme-

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tric, and consequently must be a square-root, of the form deduced in the last article, namely,

$$a_1' = b\,(x_1 - x_2)\ldots(x_4 - x_5),$$

the factor b being symmetric. And because any other radical of the same order, a_2', might be deduced from a_1' by a multiplication such as the following, $a_2' = \frac{c}{b}a_1'$, we see that no such other radical a_2', of the first order, can enter into the expression $b^{(m)}$, when that expression is cleared of all superfluous functional radicals. On the other hand, a two-valued expression such as

$$f_1' = b_0 + b_1 a_1'$$

cannot represent the five-valued function x; if then the sought expression $x = b^{(m)}$ exist at all, it must involve some radical of the second order, a_1'', and this radical must admit of being expressed as a rational function r_1'' of the five roots, which function is to have, itself, more than two values, but to have some prime power, $r_1''^{a_1''}$, two-valued. And since it has been proved that no such function r_1'' exists, it follows that no function of the form $b^{(m)}$ can represent the sought root x of the general equation of the fifth degree. If then that general equation admit of being resolved at all, it must be by some process distinct from any finite combination of the operations of adding, subtracting, multiplying, dividing, elevating to powers, and extracting roots of functions.

[23.] It is, therefore, impossible to satisfy the equation

$$b^{(m)5} + a_1 b^{(m)4} + a_2 b^{(m)3} + a_3 b^{(m)2} + a_4 b^{(m)} + a_5 = 0,$$

by any finite irrational function $b^{(m)}$; the five coefficients a_1, a_2, a_3, a_4, a_5 being supposed to remain arbitrary and independent. And, by still stronger reason, it is impossible to satisfy the equation

$$b^{(m)n} + a_1 b^{(m)n-1} + \ldots + a_{n-1} b^{(m)} + a_n = 0,$$

if n be greater than five, and $a_1, \ldots a_n$ arbitrary. For if we could do this, then the irrational function $b^{(m)}$ would, by the principles already established, have

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exactly n values; of which, $n-5$ values would vanish when we supposed $a_n, a_{n-1}, \ldots a_6$ to become $=0$, and the remaining five values would represent the five roots of the general equation of the fifth degree; but such a representation of the roots of that equation has been already proved to be impossible.

[24.] Although the whole of the foregoing argument has been suggested by that of Abel, and may be said to be a commentary thereon; yet it will not fail to be perceived, that there are several considerable differences between the one method of proof and the other. More particularly, in establishing the cardinal proposition that every radical in every irreducible expression for any one of the roots of any general equation is a rational function of those roots, it has appeared to the writer of this paper more satisfactory to begin by showing that the radicals of highest order will have that property, if those of lower orders have it, descending thus to radicals of the lowest order, and afterwards ascending again; than to attempt, as Abel has done, to prove the theorem, in the first instance, for radicals of the highest order. In fact, while following this last-mentioned method, Abel has been led to assume that the coefficient of the first power of some highest radical can always be rendered equal to unity, by introducing (generally) a new radical, which in the notation of the present paper may be expressed as follows:

$$\sqrt[a_k^{(m)}]{\left\{\sum_{\substack{\beta_i^{(m)} < a_i^{(m)} \\ \beta_k^{(m)}=1}} \left(b^{(m-1)}_{\beta_1^{(m)},\ldots\beta_{n^{(m)}}^{(m)}} \cdot a_1^{(m)\beta_1^{(m)}} \ldots a_{n^{(m)}}^{(m)\beta_{n^{(m)}}^{(m)}} \right) \right\}^{a_k^{(m)}}};$$

but although the quantity under the radical sign, in this expression, is indeed free from that irrationality of the mth order which was introduced by the radical $a_k^{(m)}$, it is not, in general, free from the irrationalities of the same order introduced by the other radicals $a_1^{(m)}, \ldots$ of that order; and consequently the new radical, to which this process conducts, is in general elevated to the order $m+1$; a circumstance which Abel does not appear to have remarked, and which renders it difficult to judge of the validity of his subsequent reasoning. And because the other chief obscurity in Abel's argument (in the opinion of the

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present writer) is connected with the proof of the theorem, that a rational function of five independent variables cannot have five values and five only, unless it be symmetric relatively to four of its five elements; it has been thought advantageous, in this paper, as preliminary to the discussion of the forms of functions of five arbitrary quantities, to establish certain auxiliary theorems respecting functions of fewer variables; which have served also to determine *à priori* all possible solutions (by radicals and rational functions) of all general algebraic equations below the fifth degree.

[25.] However, it may be proper to state briefly here the simple and elegant reasoning by which ABEL, after CAUCHY, has proved that if a function of five variables have fewer than five values, it must be either two-valued or symmetric. Let the function be for brevity denoted by $(\alpha, \beta, \gamma, \delta, \epsilon,)$; and let ∇ and $\nabla`$ denote such changes, that

$$(\beta, \gamma, \delta, \epsilon, \alpha) = \nabla(\alpha, \beta, \gamma, \delta, \epsilon),$$
$$(\beta, \epsilon, \alpha, \gamma, \delta) = \nabla`(\alpha, \beta, \gamma, \delta, \epsilon).$$

These changes are such that we have the two symbolic equations

$$\nabla^5 = 1, \quad \nabla`^5 = 1;$$

but also, by supposition, some two of the five functions

$$\nabla^0(\alpha, \beta, \gamma, \delta, \epsilon), \ldots \nabla^4(\alpha, \beta, \gamma, \delta, \epsilon)$$

are equal among themselves, and so are some two of the five functions

$$\nabla`^0(\alpha, \beta, \gamma, \delta, \epsilon), \ldots \nabla`^4(\alpha, \beta, \gamma, \delta, \epsilon);$$

we have therefore two equations of the forms

$$\nabla^r = 1, \quad \nabla`^{r`} = 1,$$

in which r and $r`$ are each greater than 0, but less than 5; and by combining these equations with the others just now found, we obtain

$$\nabla = 1, \quad \nabla` = 1:$$

that is

$$(\beta, \gamma, \delta, \epsilon, \alpha) = (\alpha, \beta, \gamma, \delta, \epsilon), \quad \text{and } (\beta, \epsilon, \alpha, \gamma, \delta) = (\alpha, \beta, \gamma, \delta, \epsilon).$$

Hence

$$(\gamma, \alpha, \beta, \delta, \epsilon) = (\beta, \gamma, \delta, \epsilon, \alpha) = (\alpha, \beta, \gamma, \delta, \epsilon);$$

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and in like manner,

$$(\alpha, \gamma, \varepsilon, \beta, \epsilon) = (\alpha, \beta, \gamma, \varepsilon, \epsilon) = (\gamma, \alpha, \beta, \varepsilon, \epsilon);$$

we may therefore interchange the first and second of the five elements of the function, if we at the same time interchange either the second and third, or the third and fourth; and a similar reasoning shows that we may interchange any two, if we at the same time interchange any two others. An even number of such interchanges leaves therefore the function unaltered; but every alteration of arrangement of the five elements may be made by either an odd or an even number of such interchanges: the function, therefore, is either two-valued or symmetric; it having been supposed to have fewer than five values. Indeed, this is only a particular case of a more general theorem of CAUCHY, which is deduced in a similar way: namely, that if the number of values of a rational function of n arbitrary quantities be less than the greatest prime number which is itself not greater than n, the number of values of that function must then be either two or one.

[26.] It is a necessary consequence of the foregoing argument, that there must be a fallacy in the very ingenious process by which Mr. JERRARD has attempted to reduce the general equation of the fifth degree to the solvible form of DE MOIVRE, namely,

$$x^5 - 5bx^3 + 5b^2x - 2e = 0,$$

of which a root may be expressed as follows,

$$x = \sqrt[5]{\{e + \sqrt{e^2 - b^5}\}} + \frac{b}{\sqrt[5]{\{e + \sqrt{e^2 - b^5}\}}};$$

because this process of reduction would, if valid, conduct to a finite (though complicated) expression for a root x of the general equation of the fifth degree,

$$x^5 + a_1 x^4 + a_2 x^3 + a_3 x^2 + a_4 x + a_5 = 0,$$

with five arbitrary coefficients, real or imaginary, as a function of those five coefficients, through the previous resolution of certain auxiliary equations below the fifth degree, namely, a cubic, two quadratics, another cubic, and a biqua-

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dratic, besides linear equations and De Moivre's solvible form; and therefore ultimately through the extraction of a finite number of radicals, namely, a square-root, a cube-root, three square-roots, a cube-root, a square-root, a cube-root, three square-roots, and a fifth-root. Accordingly, the fallacy of this process of reduction has been pointed out by the writer of the present paper, in an "Inquiry into the Validity of a Method recently proposed by George B. Jerrard, Esq., for transforming and resolving Equations of Elevated Degrees:" undertaken at the request of the British Association for the Advancement of Science, and published in their Sixth Report. But the same Inquiry has confirmed the adequacy of Mr. Jerrard's method to accomplish an almost equally curious and unexpected transformation, namely, the reduction of the general equation of the fifth degree to the trinomial form

$$x^5 + Dx + E = 0;$$

and therefore ultimately to this very simple form

$$x^5 + x = e;$$

in which, however, it is essential to observe that e will in general be imaginary even when the original coefficients are real. If then we make, in this last form,

$$x = \rho(\cos\theta + \sqrt{-1}\sin\theta),$$

and

$$e = r(\cos v + \sqrt{-1}\sin v),$$

we can, by the help of Mr. Jerrard's method, reduce the general equation of the fifth degree, with five arbitrary and imaginary coefficients, to the system of the two following equations, which involve only real quantities:

$$\rho^5\cos 5\theta + \rho\cos\theta = r\cos v;$$
$$\rho^5\sin 5\theta + \rho\sin\theta = r\sin v;$$

in arriving at which system, the quantities r and v are determined, without tentation, by a finite number of rational combinations, and of extractions of square-roots and cube-roots of imaginaries, which can be performed by the help of the usual logarithmic tables; and ρ and θ may afterwards be found from r and v, by

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two new tables of double entry, which the writer of the present paper has had the curiosity to construct and to apply.

[27.] In general, if we change x to $x+\sqrt{-1}\,y$, and a_i to $a_i+\sqrt{-1}\,b_i$, the equation of the fifth degree becomes

$$(x+\sqrt{-1}\,y)^5+(a_1+\sqrt{-1}\,b_1)(x+\sqrt{-1}\,y)^4 \\ +\ldots+a_5+\sqrt{-1}\,b_5=0,$$

and resolves itself into the two following:

$$\text{I.}\ldots \quad x^5-10x^3y^2+5xy^4 \\ +a_1(x^4-6x^2y^2+y^4)-b_1(4x^3y-4xy^3) \\ +a_2(x^3-3xy^2)-b_2(3x^2y-y^3) \\ +a_3(x^2-y^2)-2b_3xy \\ +a_4x-b_4y+a_5=0;$$

and

$$\text{II.}\ldots \quad 5x^4y-10x^2y^3+y^5 \\ +a_1(4x^3y-4xy^3)+b_1(x^4-6x^2y^2+y^4) \\ +a_2(3x^2y-y^3)+b_2(x^3-3xy^2) \\ +2a_3xy+b_3(x^2-y^2) \\ +a_4y+b_4x+b_5=0;$$

in which all the quantities are real: and the problem of resolving the general equation with imaginary coefficients is really equivalent to the problem of resolving this last system; that is, to the problem of deducing, from it, *two real functions* (x and y) *of* TEN *arbitrary real quantities* $a_1,\ldots a_5, b_1,\ldots b_5$. Mr. JERRARD has therefore accomplished a very remarkable simplification of this general problem, since he has reduced it to the problem of discovering *two real functions of* TWO *arbitrary real quantities*, by showing that, without any real loss of generality, it is permitted to suppose

$$a_1=a_2=a_3=b_1=b_2=b_3=b_4=0,$$

and

$$a_4=1,$$

a_5 and b_5 alone remaining arbitrary: though he has failed (as the argument de-

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veloped in this paper might have shown beforehand that he must necessarily fail) in his endeavour to calculate the latter two, or the former ten functions, through any finite number of extractions of square-roots, cube-roots, and fifth-roots of expressions of the form $a + \sqrt{-1}\, b$.

[28.] But when we come to consider in what sense it is true that we are in possession of methods for extracting, without tentation, such roots of such imaginary expressions; and therefore in what sense we are permitted to postulate the extraction of such radicals, or the determination of both x and y, in an imaginary equation of the form

$$x + \sqrt{-1}\, y = \sqrt[a]{a + \sqrt{-1}\, b},$$

as an instrument of calculation in algebra; we find that this depends ultimately on our being able to reduce all such extractions to the employment of *tables of single entry*: or, in more theoretical language, to *real functions of single real variables*. In fact, the equation last-mentioned gives

$$(x + \sqrt{-1}\, y)^a = a + \sqrt{-} b,$$

that is, it gives the system of the two following:

$$x^a - \frac{a(a-1)}{1 \cdot 2}\, x^{a-2}\, y^2 + \&c. = a,$$

$$a x^{a-1}\, y - \frac{a(a-1)\,(a-2)}{1 \cdot 2 \cdot 3}\, x^{a-3}\, y^3 + \&c. = b;$$

which, again, give

$$(x^2 + y^2)^a = a^2 + b^2,$$

and

$$\frac{a\,\frac{y}{x} - \frac{a(a-1)(a-2)}{1 \cdot 2 \cdot 3}\left(\frac{y}{x}\right)^3 + \cdots}{1 - \frac{a(a-1)}{1 \cdot 2}\left(\frac{y}{x}\right)^2 + \ldots} = \frac{b}{a}.$$

If then we put

$$\phi_1(\rho) = \rho^a,$$

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and

$$\phi_2(\tau) = \frac{a\tau - \frac{a(a-1)(a-2)}{1\,.\,2\,.\,3}\tau^3 + \ldots}{1 - \frac{a(a-1)}{1\,.\,2}\tau^2 + \ldots};$$

and observe that these two real and rational functions ϕ_1 and ϕ_2 of single real quantities have always real inverses, ϕ_1^{-1} and ϕ_2^{-1}, at least if the operation ϕ_1^{-1} be performed on a positive quantity, while the function $\phi_1^{-1}(r^2)$ has but one real and positive value, and the function $\phi_2^{-1}(t)$ has a real values; we see that the determination of x and y in the equation

$$x + \sqrt{-1}\,y = \sqrt[a]{a + \sqrt{-1}\,b},$$

comes ultimately to the calculation of the following real functions of single real variables, of which the inverse functions are rational:

$$x^2 + y^2 = \phi_1^{-1}(a^2 + b^2);$$

$$\frac{y}{x} = \phi_2^{-1}\left(\frac{b}{a}\right);$$

and to the extraction of a single real square-root, which gives

$$x = \pm\sqrt{\left\{\frac{\phi_1^{-1}(a^2+b^2)}{1+\left(\phi_2^{-1}\frac{b}{a}\right)^2}\right\}},$$

$$y = \pm\left(\phi_2^{-1}\frac{b}{a}\right)\cdot\sqrt{\left\{\frac{\phi_1^{-1}(a^2+b^2)}{1+\left(\phi_2^{-1}\frac{b}{a}\right)^2}\right\}}.$$

Now, notwithstanding the importance of those two particular forms of rational functions ϕ_1 and ϕ_2 which present themselves in separating the real and imaginary part of the radical $\sqrt[a]{a + \sqrt{-1}\,b}$, and of which the former is a power of a single real variable, while the latter is the tangent of a multiple and real arc expressed in terms of the single and real arc corresponding; it may appear with reason that these functions do not both possess such an eminent prerogative of simplicity as to entitle the *inverses of them alone* to be admitted into elementary algebra, to the exclusion of the inverses of all other real and rational functions of single real variables. And since the general equation of the fifth degree, with real or

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imaginary coefficients, has been reduced, by Mr. JERRARD's* method, to the system of the two real equations

$$x^5 - 10x^3y^2 + 5xy^4 + x = a,$$
$$5x^4y - 10x^2y^3 + y^5 + y = b,$$

it ought, perhaps, to be now the object of those who interest themselves in the improvement of this part of algebra, to inquire whether the dependence of the two real numbers x and y, in these two last equations, on the two real numbers a and b, cannot be expressed by the help of the real inverses of some new real and rational, or even transcendental functions of single real variables; or, (to express the same thing in a practical, or in a geometrical form,) to inquire whether the two sought real numbers cannot be calculated by a finite number of tables of single entry, or constructed by the help of a finite number of curves: although the argument of ABEL excludes all hope that this can be accomplished, if we confine ourselves to those particular forms of rational functions which are connected with the extraction of radicals.

It may be proper to state, that in adopting, for the convenience of others, throughout this paper, the usual language of algebraists, especially respecting real and imaginary quantities, the writer is not to be considered as abandoning the views which he put forward in his Essay on Conjugate Functions, and on Algebra as the Science of Pure Time, published in the second Part of the seventeenth volume of the Transactions of the Academy: which views he still hopes to develope and illustrate hereafter.

He desires also to acknowledge, that for the opportunity of reading the original argument of ABEL, in the first volume of CRELLE's Journal, he is indebted to the kindness of his friend Mr. LUBBOCK; and that his own remarks were written first in private letters to that gentleman, before they were thrown into the form of a communication to the Royal Irish Academy.

* *Mathematical Researches*, by George B. Jerrard, Esq., A. B.; printed by William Strong, Clare-street, Bristol.

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ADDITION.

Since the foregoing paper was communicated, the writer has seen, in the first Part of the Philosophical Transactions for 1837, an essay entitled "Analysis of the Roots of Equations," by a mathematician of very high genius, the Rev. R. MURPHY, Fellow of Caius College, Cambridge; who appears to have been led, by the analogy of the expressions for roots of equations of the first four degrees, to conjecture that the five roots $x_1\, x_2\, x_3\, x_4\, x_5$ of the general equation of the fifth degree,

$$x^5 + ax^4 + bx^3 + cx^2 + dx + e = 0, \qquad (1)$$

can be expressed as finite irrational functions of the five arbitrary coefficients a, b, c, d, e, as follows:

$$\left.\begin{aligned}
x_1 &= \frac{-a}{5} + \sqrt[5]{\alpha} + \sqrt[5]{\beta} + \sqrt[5]{\gamma} + \sqrt[5]{\delta}, \\
x_2 &= \frac{-a}{5} + \omega\sqrt[5]{\alpha} + \omega^2\sqrt[5]{\beta} + \omega^3\sqrt[5]{\gamma} + \omega^4\sqrt[5]{\delta}, \\
x_3 &= \frac{-a}{5} + \omega^2\sqrt[5]{\alpha} + \omega^4\sqrt[5]{\beta} + \omega\sqrt[5]{\gamma} + \omega^3\sqrt[5]{\delta}, \\
x_4 &= \frac{-a}{5} + \omega^3\sqrt[5]{\alpha} + \omega\sqrt[5]{\beta} + \omega^4\sqrt[5]{\gamma} + \omega^2\sqrt[5]{\delta}, \\
x_5 &= \frac{-a}{5} + \omega^4\sqrt[5]{\alpha} + \omega^3\sqrt[5]{\beta} + \omega^2\sqrt[5]{\gamma} + \omega\sqrt[5]{\delta},
\end{aligned}\right\} \qquad (2)$$

ω being an imaginary fifth-root of unity, and $\alpha\ \beta\ \gamma\ \delta$ being the four roots of an auxiliary biquadratic equation,

$$\left.\begin{aligned}
\alpha &= a' + \sqrt{\beta'} + \sqrt{\gamma'} + \sqrt{\delta'}, \\
\beta &= a' + \sqrt{\beta'} - \sqrt{\gamma'} - \sqrt{\delta'}, \\
\gamma &= a' - \sqrt{\beta'} + \sqrt{\gamma'} - \sqrt{\delta'}, \\
\delta &= a' - \sqrt{\beta'} - \sqrt{\gamma'} + \sqrt{\delta'};
\end{aligned}\right\} \qquad (3)$$

in which $\beta'\ \gamma'\ \delta'$ are the three roots of an auxiliary cubic equation,

$$\left.\begin{aligned}
\beta' &= a'' + \sqrt[3]{\beta''} + \sqrt[3]{\gamma''}, \\
\gamma' &= a'' + \theta\sqrt[3]{\beta''} + \theta^2\sqrt[3]{\gamma''}, \\
\delta' &= a'' + \theta^2\sqrt[3]{\beta''} + \theta\sqrt[3]{\gamma''};
\end{aligned}\right\} \qquad (4)$$

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θ being an imaginary cube-root of unity, and β'' γ'' being the two roots of an auxiliary quadratic,

$$\left.\begin{aligned}\beta'' &= a''' + \surd a^{IV},\\ \gamma'' &= a''' - \surd a^{IV}.\end{aligned}\right\} \quad (5)$$

And, doubtless, it is allowed to represent any five arbitrary quantities x_1 x_2 x_3 x_4 x_5 by the system of expressions (2) (3) (4) (5), in which a, ω, and θ are such that

$$a = -(x_1 + x_2 + x_3 + x_4 + x_5), \qquad (6)$$

$$\omega^4 + \omega^3 + \omega^2 + \omega + 1 = 0, \qquad (7)$$

$$\theta^2 + \theta + 1 = 0, \qquad (8)$$

provided that the auxiliary quantities $\alpha\,\beta\,\gamma\,\delta$ $\alpha'\,\beta'\,\gamma'\,\delta'$ $\alpha''\,\beta''\,\gamma''$ α''' α^{IV} be determined so as to satisfy the conditions

$$\left.\begin{aligned}5\sqrt[5]{\alpha} &= x_1 + \omega^4 x_2 + \omega^3 x_3 + \omega^2 x_4 + \omega x_5,\\ 5\sqrt[5]{\beta} &= x_1 + \omega^3 x_2 + \omega x_3 + \omega^4 x_4 + \omega^2 x_5,\\ 5\sqrt[5]{\gamma} &= x_1 + \omega^2 x_2 + \omega^4 x_3 + \omega x_4 + \omega^3 x_5,\\ 5\sqrt[5]{\delta} &= x_1 + \omega x_2 + \omega^2 x_3 + \omega^3 x_4 + \omega^4 x_5,\end{aligned}\right\} \quad (9)$$

$$\left.\begin{aligned}4\alpha' &= \alpha + \beta + \gamma + \delta,\\ 4\surd\beta' &= \alpha + \beta - \gamma - \delta,\\ 4\surd\gamma' &= \alpha - \beta + \gamma - \delta,\\ 4\surd\delta' &= \alpha - \beta - \gamma + \delta,\end{aligned}\right\} \quad (10)$$

$$\left.\begin{aligned}3\alpha'' &= \beta' + \gamma' + \delta',\\ 3\sqrt[3]{\beta''} &= \beta' + \theta^2\gamma' + \theta\delta',\\ 3\sqrt[3]{\gamma''} &= \beta' + \theta\gamma' + \theta^2\delta',\end{aligned}\right\} \quad (11)$$

$$\left.\begin{aligned}2\alpha''' &= \beta'' + \gamma'',\\ 2\surd\alpha^{IV} &= \beta'' - \gamma''.\end{aligned}\right\} \quad (12)$$

But it is not true that the four auxiliary quantities α', α'', α''', α^{IV}, determined by these conditions, are symmetric functions of the five quantities x_1, x_2, x_3, x_4, x_5, or rational functions of a, b, c, d, e, as Mr. MURPHY appears to have conjectured them to be.

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In fact, the conditions just mentioned give, in the first place, expressions for $\alpha, \beta, \gamma, \delta, \alpha'$, as functions of the five roots x_1, x_2, x_3, x_4, x_5, which functions are rational and integral and homogeneous of the fifth dimension; they give, next, expressions for $\beta', \gamma', \delta', \alpha''$, as functions of the tenth dimension; for $\beta'', \gamma'', \alpha'''$, of the thirtieth; and for α^{IV}, of the sixtieth dimension. And Mr. MURPHY has rightly remarked that this function α^{IV} may be put under the form

$$\alpha^{IV} = k\, \mathrm{A}_1^2 . \mathrm{A}_2^2 . \mathrm{A}_3^2 . \mathrm{A}_4^2 . \mathrm{A}_5^2 . \mathrm{A}_6^2 . \mathrm{B}_1^2 .. \mathrm{B}_6^2 . \mathrm{C}_1^2 .. \mathrm{C}_6^2 . \mathrm{D}_1^2 .. \mathrm{D}_6^2 . \mathrm{E}_1^2 .. \mathrm{E}_6^2, \quad (13)$$

in which k is a numerical constant, and

$$\left.\begin{aligned} \mathrm{A}_1 &= x_2 - x_4 + \omega(x_3 - x_4) + \omega^2(x_3 - x_5), \\ \mathrm{A}_2 &= x_3 - x_2 + \omega(x_5 - x_2) + \omega^2(x_5 - x_4), \\ \mathrm{A}_3 &= x_4 - x_5 + \omega(x_2 - x_5) + \omega^2(x_2 - x_3), \\ \mathrm{A}_4 &= x_5 - x_3 + \omega(x_4 - x_3) + \omega^2(x_4 - x_2), \end{aligned}\right\} \quad (14)$$

$$\left.\begin{aligned} \mathrm{A}_5 &= x_2 - x_5 + (\omega^2 + \omega^3)\,(x_3 - x_4), \\ \mathrm{A}_6 &= x_3 - x_4 + (\omega^2 + \omega^3)\,(x_5 - x_2); \end{aligned}\right\} \quad (15)$$

these six being the only linear factors of $\sqrt{\frac{\alpha^{IV}}{k}}$ which do not involve x_1. But the expressions (14) give, by (7),

$$\left(\frac{\omega}{1+\omega}\right)^2 \mathrm{A}_1 \mathrm{A}_2 \mathrm{A}_3 \mathrm{A}_4 = \{x_2^2 + x_3^2 + x_4^2 + x_5^2 - (x_2 + x_5)(x_3 + x_4)\}^2$$
$$+ \{(x_2 - x_5)^2 + (x_2 - x_4)(x_5 - x_3)\}\{(x_3 - x_4)^2 + (x_2 - x_3)(x_5 - x_4)\}; \quad (16)$$

and the expressions (15) give

$$\frac{\omega^3}{1+\omega} \mathrm{A}_5 \mathrm{A}_6 = (x_3 - x_4)^2 + (x_2 - x_5)(x_3 - x_4) - (x_2 - x_5)^2; \quad (17)$$

the part of α^{IV}, which is of highest dimension relatively to x_1, is therefore of the form

$$\mathrm{N}\, x_1^{48} \Big(\{x_2^2 + x_3^2 + x_4^2 + x_5^2 - (x_2 + x_5)(x_3 + x_4)\}^2$$
$$+ \{(x_2 - x_5)^2 + (x_2 - x_4)(x_5 - x_3)\}\{(x_3 - x_4)^2 + (x_2 - x_3)(x_5 - x_4)\}\Big)^2$$
$$\times \{(x_3 - x_4)^2 + (x_3 - x_5)(x_3 - x_4) - (x_2 - x_5)^2\}^2, \quad (18)$$

N being a numerical coefficient; and consequently the coefficients, in α^{IV}, of the

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products $x_1^{48} x_2^{11} x_3$ and $x_1^{48} x_2 x_3^{11}$ are, respectively, $-6N$ and $-4N$; they are therefore unequal, and a^{IV} is not a symmetric function of x_1, x_2, x_3, x_4, x_5.

The same defect of symmetry may be more easily proved for the case of the function a', by observing that when x_1 and x_3 are made $= 0$, the expression

$$\left.\begin{aligned} 4 \cdot 5^5 \cdot a' = {} & (x_1 + \omega x_2 + \omega^2 x_3 + \omega^3 x_4 + \omega^4 x_5)^6 \\ & + (x_1 + \omega^2 x_2 + \omega^4 x_3 + \omega x_4 + \omega^3 x_5)^6 \\ & + (x_1 + \omega^3 x_2 + \omega x_3 + \omega^4 x_4 + \omega^2 x_5)^6 \\ & + (x_1 + \omega^4 x_2 + \omega^3 x_3 + \omega^2 x_4 + \omega x_5)^6 \end{aligned}\right\} \quad (19)$$

becomes

$$\begin{aligned} & (x_2 + \omega x_3 + \omega^2 x_4)^6 + (x_2 + \omega^2 x_3 + \omega^4 x_4)^6 \\ & + (x_2 + \omega^3 x_3 + \omega x_4)^6 + (x_2 + \omega^4 x_3 + \omega^3 x_4)^6 \\ & = 4 x_2^6 - 5 x_2^4 (x_3 + x_4) - 10 x_2^3 (x_3^2 + 2 x_3 x_4 + x_4^2) \\ & - 10 x_2^2 (x_3^3 + 3 x_3^2 x_4 - 12 x_3 x_4^2 + x_4^3) \\ & - 5 x_2 (x_3^4 - 16 x_3^3 x_4 + 6 x_3^2 x_4^2 + 4 x_3 x_4^3 + x_4^4) \\ & + 4 x_3^6 - 5 x_3^4 x_4 - 10 x_3^3 x_4^2 - 10 x_3^2 x_4^3 - 5 x_3 x_4^4 + 4 x_4^6, \end{aligned} \quad (20)$$

which is evidently unsymmetric.

The elegant analysis of Mr. MURPHY fails therefore to establish any conclusion opposed to the argument of ABEL.

The Reader is requested to make the following Corrections:

In article [7.], the biquadratic equation ought to be $x^4 +$ &c.

In the first page of article [14.], read $a_1'^{a_1'} = f_1(a_1, a_2, a_3)$, and $a_1' = v_1'(x_1, x_2, x_3)$.

In the enumeration, in article [19.], of the cases in which the twelve-valued function (*II.*) has a six-valued square, insert:

or of the form

$$v = (x_\alpha + x_\beta - x_\gamma - x_\delta)\,\psi\,(\overline{x_\alpha + x_\beta - x_\gamma - x_\delta} \cdot \overline{x_\alpha - x_\beta} \cdot \overline{x_\gamma - x_\delta}).$$

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XIV. *On the Irish Hare.* (*Lepus Hibernicus.*) *By* William Thompson, Esq., *Vice-President of the Natural History Society of Belfast.*

Read 28th May, 1838.

THE Earl of Derby was the first to call the attention of English zoologists to the differences existing between the common hare of Great Britain and that of Ireland; and for the purpose of having the matter duly investigated, he, in April, 1833, transmitted specimens of the Irish hare to Mr. Yarrell, who exhibited them at a meeting of the Linnæan Society. In the month of July in the same year, this gentleman introduced the subject to the Zoological Society, at the same time pointing out some of the more prominent characters which distinguish the two animals. With regard to the specific difference of the Irish hare, Mr. Yarrell did not on either occasion offer an opinion. Mr. Jenyns, in his Manual of British Vertebrate Animals, published in 1835, introduced the Irish hare as a variety of the *Lepus timidus*, with the remark, that it "might almost deserve to be considered a distinct species." Mr. Bell, in his work on British Quadrupeds, completed in 1837, judging from external characters, brought it forward for the first time as a different animal from the common hare of England. In a communication to the Magazine of Zoology and Botany for August, 1837, Mr. Eyton stated, that from an investigation of the anatomical characters of the Irish hare, he detected such differences as "would probably distinguish it as a species, distinct from the common hare, did no other characters exist," (vol. ii. p. 283.)

Having thus looked retrospectively to the Irish hare, from the first simple announcement of the characters in which it differs from the *Lepus timidus*, until from internal, as well as external evidence, it is considered specifically different, it may be thought unnecessary to treat further on the subject, but the sequel will, I trust, show, that it has not yet been entirely exhausted.

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The very erroneous idea prevails in some quarters that the hare of Ireland was not known to differ from that of England, until the subject was introduced in London in the year 1833. Respecting the former animal, Mr. Bell observes, that "it is certainly a very remarkable circumstance that it should have remained unnoticed until so late a period, and can only be accounted for by the fact, that it is the only hare found in Ireland, and that therefore the opportunity of comparison did not frequently occur," (p. 342.) The difference between the hare of Ireland, and that of England and Scotland, has however, though not committed to the press, been long known in this country to the oldest sportsmen, dealers in animal skins, and such other persons as had the opportunity of examining them.* Yet, strange to say, to naturalists generally, what is here quoted from the "British Quadrupeds" correctly applies; the subject having been for the first time introduced to the scientific world at the period to which allusion has been made.

With the club of the Linnæan Society I happened to dine upon the day on which the specimens were received from Lord Derby, (then Lord Stanley,) and on the evening of which the subject of the Irish hare was first brought forward. On being questioned by the chairman, I had then the pleasure of stating as a fact well known in the north of Ireland, all the external, and likewise the culinary differences† existing between the hares of the two countries, but at

* On account of the difference between these animals in the two countries, the late David Ker, Esq., upwards of thirty years ago had some hares brought from England, and turned out on the largest of the three Copeland Islands, off the coast of Down, where, however, they did not much increase, and long since became extinct. About twenty years ago, a sporting friend, when visiting the island of Islay, off the coast of Argyleshire, killed several individuals of the Irish hare, as well as of the indigenous one, and on pointing out the former to some persons resident in the island, was informed that they were not any novelty, as the species had been introduced from Ireland by the chief proprietor of the island, but at what period I have not learned. It may be in reference to these, that Daniel, in his "Rural Sports," observes, with respect to the size of hares in different parts of the British Islands, that "the smallest are in the Isle of Islay." In a journal kept by that distinguished naturalist, the late John Templeton, in which criticisms on the works he read, and observations on passing events, as well as on objects of natural history, are recorded, I find the following note under date of Jan. 10, 1807. With reference to the different quality of the fur in hares mentioned in Lessep's Travels in Kamtschatka, it is remarked—"It is known that the Scotch hares have a fine wool fit for making hats, while the fur of the Irish hare is not accounted of any use."

† The Scotch and English hares are at every age, and for all culinary purposes, generally esteemed superior as food to the Irish.

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the same time added, that we regarded the hare of Ireland only as a very distinct and well-marked variety of *Lepus timidus*. Further than this, as has been already noticed, Mr. Yarrell and Mr. Jenyns did not go, Mr. Bell being the first to characterize it as a species.* That it really is such I became at once satisfied on a very minute examination of Scotch and Irish specimens towards the end of 1833. About this time my friend Mr. Yarrell requested from me the fullest information on the animal, preparatory to his drawing up a paper on it, and for him such facts as I was conversant with were reserved, knowing as I did that in such truly able hands the subject must be judiciously treated. In furtherance of the inquiry, I had at that time the pleasure of transmitting him a specimen of the animal, and of presenting others to the British Museum. In consequence of Mr. Yarrell having now relinquished this intention, I am induced to bring together here such particulars of the history, &c. of this animal as are known to me.

In consulting the Mammalogie of Desmarest, and Synopsis Mammalium of Fischer, the two latest general works upon the subject, I find that there is not any species of *Lepus* described, corresponding to the hare of Ireland, nor is there such in any other work to which I have had access. The species known on the continent of Europe are but two in number, both of which, the *Lepus timidus* and *Lepus variabilis*, are natives of the British Islands. Between these species only, and the hare of Ireland, does it seem necessary to draw any comparison. Considered in connexion with them, it holds in several points of view, both as to form and colour, such as the relative length of ears to head, length of tail, in assuming a white garb, (though not periodically,) &c., an intermediate place. The habits of the Alpine hare, together with the localities to which it is restricted, are very different from those of the Irish species; the latter animal in these respects exactly agreeing with the *Lepus timidus*.

Specimens of the hare of Ireland and of Scotland, from the approximating counties of Down and Wigton, and examined in a recent state, presented the following differences :†

* In the article "Hare," published in the British Cyclopædia of Natural History, (1836,) it is likewise so mentioned, vol. ii. p. 705. In a note contributed by the late E. T. Bennet, in his edition of White's Selborne, (1837,) it is remarked that "Ireland has also its peculiar hare," p. 128.

† The males were obtained in February; the females in December. The latter are in both species generally larger than the males.

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	Irish Hare.				Scotch Hare.			
	Male. *Weight,* 5lbs. 3oz.		Female. *Weight,* 7lbs. 4½oz.		Male. *Weight,* 6lbs. 8oz.		Female. *Weight,* 6lbs. 9½oz.	
	Inch.	Line.	Inch.	Line.	Inch.	Line.	Inch.	Line.
Length of head and body to upper base of tail	20	0	24	6	22	6	21	0
„ from nose to point of middle claw of hind leg when stretched out	27	2	..	..	30	0	..	..
„ of head, measured with compasses	4	8	..	..	4	9	..	..
„ of head, from anterior base of ear, measured as last	..	..	4	0	..	..	4	0
„ of head from forehead, on a line with anterior base of ears, following its curve to the nasal slit	5	0	5	0	5	0	5	0
„ of ears posteriorly, including fur	4	5	..	..	4	9	..	..
„ of ears, from anterior base	4	2	4	3	4	1*	4	10
„ of tail, including hair	..	..	4	0	4	3	5	0
„ of tail, to end of fleshy portion	2	0	2	6	3	0	3	6
„ of whiskers	3	6	3	6	4	0	4	6
„ from shoulder in a straight line, to end of hairs which extend a little beyond middle nail	14	0	..	..	13	0	..	..
„ from sole of fore foot to back, in a straight line	..	..	12	0	..	..	11	0
FORE EXTREMITIES.								
Length of radius	4	1	4	9	4	2	4	9
„ from carpal joint to end of middle claw	2	9	3	3	2	9	3	1
„ of middle toe and claw	1	5	1	7	1	4	1	4
HIND EXTREMITIES.								
Length from knee-joint to end of middle claw, in a straight line	11	0	11	3	10	9	11	0
„ of tibia	5	0	6	0	5	4	6	0
„ of heel to point of middle claw	5	6	5	6	5	1	5	0

Colour of Irish Hare, (Female Specimen.)

Top and sides of *head* of a tolerably uniform dull reddish-brown, except an oval spot just before the eye, and of about its size, being

Colour of Scotch Hare, (Female Specimen.)

Upper surface of *head* dark-reddish brown; a white spot about the size and form of the eyes just before them; a whitish mark originating at

* Another male of this species, and of similar size, examined at the same time, had the ears thus measured—four inches two lines in length.

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somewhat paler, and close round the eye, where it is very dull white; of this colour also is the under surface of the head.

Ears presenting anteriorly a mixture of black and reddish-grey; posteriorly greyish, becoming gradually paler to the margin, which for two-thirds from the base is white; extreme tip (about six lines) black, which colour extends down the posterior margin for about one-third the length of ear.

Back and upper portion of *sides*, dull reddish-grey; under surface of *neck* pale grey; *lower parts*, from between the fore legs to tip of tail, white, except at inner base of hind legs, which are of a very pale grey; upper portion of *tail** white, with a few black hairs towards the base, giving that part a sullied or impure tinge.

Fore legs, dull reddish-brown in front and outer sides; inner and hinder portion white, which colour comes forward transversely on the outer sides of the legs just above the foot, which is brown. Sides of *hinder legs* greyish, tinged anteriorly with yellowish-brown; of this colour a stripe extends from the tarsal joint to the middle toe, and is bounded on both sides by white; entire base from tarsal joint to toe-claws dull greyish brown, inner portion of same part whitish; this varied marking more or less conspicuous in different individuals.

Lips greyish; *whiskers* uniformly white or black, or of both colours; *irides* dark hazel.

anterior point of upper surface of the eye, becoming broader posteriorly, and extending more than half way from the eye to the base of the ear.

Ears presenting anteriorly a mixture of black and reddish-grey; medial portion pure reddish-brown, which colour does not appear in the ears of the Irish species; posteriorly, from base, for about two-thirds their length, whitish, thence to tip black, of which colour a narrow marginal line extends downwards to middle of ear.

Back and upper portion of *sides* mottled with a pale-reddish colour and black, the former predominating; towards the lower portion of the sides the pale reddish-brown, or rich cinnamon colour, only appears, and this alone prevails on both sides of the *neck*, and on its lower portion; entire *under surface*, from between the fore legs to the tip of tail, white, except at inner base of hind legs, where a pale cinnamon colour prevails.

Fore legs dark reddish-brown in front and outer sides; inner and hinder portion a very pale red and white intermixed. *Hind legs*, to tarsal joint, of a grey and very pale red combined; from thence to middle toe reddish-brown, which colour becomes gradually paler posteriorly; inner portion of same part whitish.

Lips blackish; *whiskers* uniformly white or black, or of both colours; *irides* dark hazel.

* It is singular that this, the most obvious of all the differences in colour between the two species, should have been quite unnoticed by the several authors who have written on the Irish hare, more especially as the colour of the tail is always one of the few leading characters given of *Lepus timidus*, both by British and Continental authors. On questioning some of the Belfast dealers in hares as to their means of knowing the two species, I found that the difference of colour in the tail was one of their marks of distinction;—with every external character indeed, they are, and always have been, quite familiar.

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From this comparative description it appears that the *Lepus timidus* displays greater diversity of colour in the head, ears, and body, than *Lepus Hibernicus*, and that the latter exhibits greater variety in the disposition of colours on the legs.

On looking to the visceral anatomy along with my friend, Dr. J. L. Drummond, the following measurements were made:

	Irish Hare. Male. *Weight*, 5lbs. 3oz.		Scot. Hare. Male. *Weight*, 6lbs. 2oz.	
	Feet.	Inch.	Feet.	Inch.
Length of small intestines from stomach to cœcum	12	10	14	0
„ of cœcum from termination of the ileum	1	6½	2	0
„ of colon	4	5	4	8
„ of rectum	3	0	3	0

In the following table a comparative view is presented of the osteological characters of the two species:

	Irish Hare.				Scot. Hare.	
	Male. *Original Wt.* 5lbs. 3oz.		Female. *Original Wt.* 7lbs. 4½oz.		Female. *Original Wt.* 7lbs. 4oz.	
	Inch.	Line.	Inch.	Line.	Inch.	Line.
Length of head	3	6	3	8	3	9
Breadth of head above the meatus anditorii	1	2	1	1½	1	1
„ at the zygomata	1	9	1	10½	1	10½
Distance between the superciliary ridges	1	2½	1	3	1	2½
Length of humerus	3	9	3	10	3	10
„ of radius	3	10	4	0½	4	3½
„ of ulna	4	7	4	8½	4	11
„ from base of radius to lower extremity of metacarpus	1	4	1	6	1	6
„ of second finger and nail	1	4	1	8	1	7
„ of femur	4	6	4	8	4	10½
„ of tibia	5	1½	5	3	5	7
„ of os calcis	1	2	1	2	1	2
„ from base of os calcis to lower extremity of metatarsus	2	4	2	3	2	5
„ of second toe and claw, measured in a straight line	1	10	2	1½	2	0
„ from upper extremity of os calcis to lower extremity of matatarsus	3	7	3	6	3	6
„ of scapula	2	10	3	2	3	2
Breadth of scapula	1	6	1	10½	1	10½
Length of pelvis	3	4	3	7	3	10½

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This table, which exhibits a comparison of two female specimens of equal size and weight, shows a very different result from that arrived at by Mr. Eyton, who observes, that the skeleton generally of the Irish hare is larger than that of the English; that the lateral processes of its lumbar vertebræ are longer; its scapula and ribs broader, and its cranium* larger; but in all these characters an equality is presented by the individuals under consideration.† Mr. Eyton further adds, that the Irish is distinguished from the common hare by "the greater length of the humerus, in proportion to that of the ulna;" but in these individuals the humerus is equal, and the ulna of the *Lepus timidus* of superior length. As remarked by Mr. Eyton,—"in the numbering of the vertebræ and ribs (twelve in number) they do not differ, except as to the caudal ones, which in the Irish hare are thirteen, and in the English sixteen; the sacral in both are four, the lumbar seven, the dorsal twelve, and cervical seven; making the total number in the Irish hare forty-three, and in the common hare forty-six." The teeth appear in all respects similar in both species. The orbits are somewhat more of an oval form in the Irish than in the common hare.

The most obvious characters of *form* between the common and Irish hare are the superior length of ears and tail,‡ and the less rounded head of the former animal: those of *colour* have been before noticed. The *specific character* I propose for it is: *Fur above uniform dull reddish-grey; tail whitish above; ears and tail shorter than head.*

The description of colour which has been drawn up does not apply to the Irish hare at every age, and here is an important difference between this and its

* Although this can hardly be called larger, there is some difference in form between it and that of *Lepus timidus*.

† Although the lumbar vertebræ are not in reality longer in the Irish species, yet from taking a more horizontal direction they so appear when the animal is viewed with its head towards the spectator.

‡ The greater length of these parts gives an erroneous idea of superior size to the *Lepus timidus* when there is an equality in the length of its head and body, and in weight. Mr. Bell and Mr. Eyton, judging, it may be presumed, from the individuals examined by them, describe the Irish as larger than the common hare; but the difference in size is, I consider, dependent on locality, as both species differ remarkably in this respect in the barren and mountainous parts of the country, and in the rich demesnes of the valley, where they are protected. In general I should say the *Lepus timidus* is the larger animal.

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approximate species. The *Lepus timidus* sometimes, though rarely, becomes white, like various other animals; the *Lepus variabilis* annually appears so at the beginning of winter, throughout which it so continues. The *Lepus Hibernicus*, on the other hand, assumes this colouring with age. This inference I was at first inclined to draw from the fact, that it was only in preserves, or where they were unmolested, that I remarked them to be parti-coloured, or almost pure white; their enemies, where they are not protected, being so numerous, as to prevent the attainment of their natural term of life.* To the same effect I have the evidence of a most intelligent game-keeper, who states, that hares turned out young into a demesne in the County of Down, and marked by a piece being taken out of their ears, regularly became white in the hinder parts during the fifth spring; in the sixth this colour extended over the sides; in the seventh they were all white but the head; and in the eighth, he thinks, pure white. In all these stages but the last, they have occurred to myself. In a park in the County of Antrim, he has made similar remarks, though without the precise *datum* afforded in the first instance. Here he judges from hares frequenting particular haunts gradually presenting the white appearance just described, and which I am inclined to believe is occasioned by a change of colour in the existing fur. About the month of February the whiteness of garb exhibited from the fifth to the eighth year begins to appear, and is borne through March and April, when the annual change of fur takes place, and the white is thrown off for that of ordinary colour.

In the Belfast Museum there is a specimen (from Shane's Castle-Park, County of Antrim) which retains the ordinary colour only on the upper portion of the head and front of the ears, the tips, as in the Alpine hare in winter garb, retaining their blackness. The entire of the remainder, except a small portion at the base of the fore-legs, tinged with pale fawn colour, appears of a pure white; but on close examination exhibits along the back, and on the breast, unchanged in colour, some long black hairs;† the lips are whitish.

* In the note by Mr. Bennet, of which part has been already quoted, it is remarked, but without any reason being assigned for it, that the Irish hare is "apt to become white in winter when kept in parks or other enclosures," p. 128.

† These "long hairs" which have been described as altogether wanting in the Irish species, exist in every specimen I have examined, but are extremely few in number, compared with those in the common hare.

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Within one week, in the month of October, 1829, I had the opportunity of observing the three species of British hare in their native haunts: the *Lepus Hibernicus* about Belfast; the *Lepus timidus*, towards the base of the higher Grampians at Glenlyon, in the north-west of Perthshire; and the *Lepus variabilis*, about the summits of the same noble mountains. Of the Alpine hare, some individuals which were killed in the last week of this month, had not in any degree changed the colour of their dark summer fur, whilst at the same time others were almost entirely white.* The motion and general appearance of these animals when not much alarmed, their place of refuge being at hand, seemed intermediate between those of the common hare and rabbit; but when they had wandered from the summits of the mountains, where no sheltering crevices of rocks were nigh, and their strength was put forth by the pursuit of the shepherds' dogs, they exhibited very considerable speed.

The *Lepus Hibernicus* is in a wild state easily distinguished from the *Lepus timidus*, by its shorter ears, differently coloured fur, and by the whiteness of the upper surface of its tail. This last-named distinction can rarely be observed except in parks where the animals are preserved, and where admitting of a near approach, they move gently off; but in such places the difference is very obvious.

Some sporting friends, who from coursing much, both in Ireland and Scotland, have had ample opportunities of observing the difference between the two species before greyhounds, consider that in an open country the Irish hare goes off faster from the dogs than the Scotch, and is thus less likely to be killed at at the first dash: in other respects their speed is equal. This was remarked in similar ground in both countries, and with the same greyhounds. It has likewise been stated by these gentlemen, that when wounded by the gun, the Scotch is more easily captured than the Irish species. It is probable that under both circumstances the difference may be owing to the hare in the Irish counties in which my friends sport, being more persecuted, and consequently more on the alert against her enemies, and I speak from personal knowledge of both countries.

* Although I am well aware that there is often a considerable difference in the period at which individuals of the same species put on such a change, yet I would suggest to the attention of persons who have the means of investigation, to ascertain whether the Alpine hare be white in winter from the first year of its existence.

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With respect to the points of economy to which allusion has not already been made, and to habits generally, there is a very great similarity between the two species. Thus the places selected for the "form" are the same, as are those for the reception of the young, the number of the latter, except in extraordinary cases, being four or five. By intelligent gamekeepers, both are considered to produce five times in the course of the year. When the parent has been killed, I have seen the young extracted with their eyes fully open, and within the first hour of their untimely birth, able to run about. Towards the end of the third week the leverets are said to be independent of their parent; and at this time, what Daniel in his Rural Sports remarks of the English hares equally applies to the Irish, that "when we meet with one young hare, we are almost certain of finding more within a small distance."

The Irish hare changes its quarters according to the weather, leaving situations exposed to cold winds for more sheltered places.

In the choice of food I am not aware of any difference between the two species. In the severity of winter, when the Irish hares betake themselves to the flower-garden, the delicate leaves of the pink or carnation are especial favourites; in the kitchen-garden, parsley and the more tender varieties of cabbage, young plants of the cauliflower and broccoli, being preferred to any of the coarser kinds; and in young plantations, consisting of an average number of species of deciduous forest trees, I have particularly remarked their predilection for the oak, not another species being touched, until the whole of these had been first barked.

Mr. Bell observes that the English hare "swims well, and takes the water readily, not for the purpose of escaping from pursuit merely, but for the sake of obtaining a plentiful supply of food." This applies equally well to the Irish hare, with the exception of the last clause of the sentence, for which I cannot vouch, though I have no doubt of its accuracy also; a friend, when quietly angling, having once observed a hare that was quite undisturbed enter and swim across the deep pool of a mountain stream, though by going a very short way lower down she could have passed in the usual manner.

When collecting marine productions, in company with Mr. Hyndman, about the entrance to Strangford Lough, in January, 1835, we at different times in one day started two hares that were lying very far out upon low rocks, upon

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which marine plants only vegetated; and had one of them remained undisturbed for only a few minutes longer, she would, without resorting to swimming, have been cut off from the mainland until the tide had ebbed, the rocks being insulated for at least the half of every twelve hours.

Were such instances as the one mentioned of the hare swimming across the stream, rather than go a short way about, general, (which they are not asserted to be,) it would seem that when undisturbed, this animal has less aversion to swimming than to leaping, as by its disinclination to the latter exertion, by far the greater portion killed in the higher grounds of Ireland fall victims. When a few stones are removed from the base of the loose mountain-walls, though their entire height be very inconsiderable, the hare will take advantage of the opening, rather than leap the wall; a habit so universally known, that by snares placed in these apertures they are easily secured, and chiefly when going to, or returning from their feeding ground. On this habit a difference was observed by a person employed as gamekeeper in the neighbourhood of Belfast, and who had previously served in the same capacity in Scotland. This man remarked, with some surprise, that in a field where hares were generally numerous, and which was separated from a plantation, where they were preserved by a mill-race, over which was a wooden pipe, that they invariably, when disturbed, ran for, and crossed over it, rather than leap the race, which the Scotch hare would have done. Although it has been thought proper to mention such trivial facts, yet no stress is laid upon them, as we find many animals very much influenced by immediate circumstances.

In the descriptions of the *Lepus timidus* I have read, there is not any notice of their herding together when numerous; but the intelligent gamekeeper before alluded to, states, that in Northamptonshire he has frequently seen them when driven out of a plantation congregate together, to the number of about thirty, in the open ground. Where the Irish hares abound, their gregarious propensity is a marked character. In several demesnes in the north of Ireland, when they were carefully preserved, they, on becoming plentiful, herded together like deer, and thus have I repeatedly seen from one to three hundred moving together in one body like these animals. In all these demesnes they eventually increased to such an extent as to prove most destructive to the plantations, &c., and were consequently destroyed in great numbers; from a demesne in the County of Down they on several occasions have been sent into Belfast

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by the cart-load. This herding together is not the result of what might be perhaps considered semi-domestication in the demesne or park, as in a perfectly free and wild state, when permitted to increase, they exhibit the same social and gregarious habit.*

* A sporting gentleman of my acquaintance, for seven or eight years kept a number of native hares in a large yard in the town of Belfast, chiefly for the purpose of keeping up a sufficient supply for his hunting ground, and in this he was from the first successful, as the females produced three times in the year. The males, perhaps from an undue proportion relatively to the females, fought so violently, that for the sake of peace, a few of them were emasculated, and in consequence grew to an amazing size. The same gentleman kept one of these hares for several years fastened like a dog, by a chain and collar. Those which had their liberty in the yard (which was extensive) never became tame; but when taken young, and pains are bestowed upon them, they exhibit considerable docility, and have been taught to play tricks, such as to beat a drum, &c.

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POLITE LITERATURE.

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POLITE LITERATURE.

ART. I. *The Punic Passage in Plautus, collated with parallel Passages of the Hebrew Scriptures. By the* Rev. JAMES HAMILTON, A.M. *of Trinity College, Dublin.*

Read 29th June, 1835.

"In iis explicandis multi hactenus frustra sudarunt. Magno molimine rem aggressi, doctis non satisfecerunt; qui eos Hannoni Pœno affingere multa dictitant de quibus nunquam cogitavit."

IT has been remarked respecting literature in general, that its value may be characterized as that of an historical cabinet, preserving the forms of thought, feeling, and expression of men of different ages and nations, but of passions and circumstances more or less like to our own; and that it is this which gives the charm to the productions of poetry, history, and eloquence, whether ancient or modern, foreign or domestic.

To this inherent interest and value, attaching generally to the classical remains of antiquity, there would seem in the drama of Plautus which contains the Punic passage, to be superadded the peculiar piquancy arising from curiosity; such as might be excited by some strange natural production, or antique work of art, if in the latter there should be an inscription in a character difficult to decypher, or in the former a coalescence of natural substances not usually combined, of which one ingredient, in itself valuable, is rendered still more so by having attached to and cohering with it another of heterogeneous quality, and at the same time both "rich and rare."

Thus imbedded in one of those productions which were the delight of the Roman literary world,* and affording a specimen of the thoughts, feelings, and

* Musas Plautino sermone locuturas fuisse si Latine loqui vellent.
QUINTILIAN, *Institut. Orat.* lib. x. cap. 1.

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language of the rival nation of another continent, the author of the piece a favourite of the Scipio's and Lælius's of the one, and its hero, if we may so speak, the supposed compatriot and coeval of the Hannibals and Hannos of the other—it is not to be wondered at that the Punic passage, with the different attempts to explicate it, should for a long period from and after the revival of literature, have engaged, and almost agitated the literary world. The wonder rather were, that the interest thus excited should during a long period (that which followed the times of Bochart and his fellows) have surceased; but that the indagation of that erudite period had exhausted, and the authority of Bochart's gigantic scholarship overlaid, if it did not settle, the till then "still vexed" discussion.

The state of comparative quiescence (rather than acquiescence) by which Bochart's lucubrations were thus followed, was within the last half century disturbed by an attempt, followed by some later attempts of the same kind, to explain the passage on the principle of a supposed affinity between the Punic language and the Irish. The fresh, and of late increased interest thus excited in the discussion, having led the author of this Essay to examine the Punic as it stands in Plautus, and while waiting for a copy he had written for of Bochart's interpretation, to attempt a translation of his own, he found, upon comparison, a considerable discrepancy between them. Having subsequently examined, as he conceives with candour, and certainly with care, the grounds of that discrepancy, he drew up that exposition of his own view, which he now submits to the consideration of the Classical and Oriental scholar;—deeply sensible that the attempt to put forth a new explication of a passage which has tasked, if not baffled, the most erudite and sagacious spirits of their times, must, in place of indulgence, expect rebuke, unless it shall approve itself to the candid scrutiny of scholars, as contributing, however humbly, to meet a desideratum in our erudition, and in some degree helping to "give the sense, and causing to understand the reading."

The author having begun these prefatory remarks by adverting to the grounds of that interest which the learned have so long continued to take in the Punic passage, cannot conclude them without avowing, that in his view it claims attention upon grounds of a still higher kind—its affinity in language and style with the Hebrew text of Scripture, and the light which it not only receives from but reflects upon certain parallel passages of Holy Writ.

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PŒNULI ACTUS QUINTI SCENA PRIMA.

HANNO *loquitur Punice.*

N' Ythalonim, uvalonuth si chorathisima comsyth,
Chym lachchunyth mumys tyalmyctibari imisci
Lipho canet hyth bynithii ad ædin bynuthii.
Byrnarob syllo homalonin uby misyrthoho.
Bythlym mothym noctothii nelechanti daschmachon.
Yssidele brim tyfel yth chylys chon, tem, liphul.
Uth bynim ysdibut thinno cuth nu Agorastocles.
Ythe manet ihy chyrsæ lycoch sith naso
Byuni id chil luhili gubylim lasibit thim.
Bodyalyt herayn nyn nuys lym moncoth lusim.
Exanolim volanus succuratim misti atticum esse
Concubitum à bello cutius beant lalacant chona enus es
Hujec silec panesse athidamascon alem induberte felono buthume
Celtum comucro lueni, at enim avoso uber bent hyach Aristoclem
Et te se aneche nasoctelia elicos alemus duberter mi comps vespiti
Aodeanec lictor bodes jussum limnimcolus.
Deos deasque veneror, qui hanc urbem colunt,
Ut, quod de meâ re huc veni, rite venerim.
Measque ut gnatas, et mei fratris filium,
Reperire me siritis: dii vostram fidem!
Quæ mihi surreptæ sunt, et fratris filium.
Sed hic mihi antehac hospes Antidamas fuit.
Eum fecisse ajunt sibi quod faciundum fuit.
Ejus filium hic prædicant esse Agorastoclem:
Deum hospitalem ac tesseram mecum fero:
In hisce habitare monstratu'st regionibus.
Hos percontabor, qui huc egrediuntur foras.

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" Ego re perpensâ accuratius sentio e sedecim versibus decem priores esse Punicos sex posteriores Lybicos—in utrisque eadem haberi quæ in Latinis quibus scena Poeta claudit."—Bochart *de Linguâ Punicâ.* (Caput VI.)

Ten Punic Lines as found in the Pœnulus, divided into Punic Words by interstitial Lines.

N|Yth|alonim|uvalonuth|si corath|isima con|sith|
Chy|m lach|chun|yth mu|mys tyalm|yctibari i|mischi-
-Li|pho|canet h|yth|byn|ithii|a|d œdin|binuthii|
Byrn|arob|syllo ho|malonin|ubym|is|yrthoho|
Byth|ly|m mo|thyn|noctothi|i n|clech|anti dasmachon;|
Yss|id|ele|brim ty|fel|yth|chyly|s cho|n ten|lyphul|
Uth|byn|im ysdi|but thin|no cuthnu|Agorastocles|
Yth|e manet|ihy|chyrs|œ ly|coch|sith|naso|
By|uni|id|chi|l|luh|ili|gubylim|lasybit|thym|
Bo|dy|alyt h|eray|n|nyn|n|uys ly|m moncoth|lusim

The same reunited into connected but distinct Vocables.

N' Yth alonim uvalonuth	si corath isimacon sith
Chy m'lach'chun ythmu	mystyalm yctibari mischili pho
Caneth yth byn ithii a(i)	doedin binuthii
Byrn arob s'yl'loho	malonim ubym is yrthoho
Byth ly m'mo thyn	noctothi i'n 'elech antidasmachon;
Yss id ele brimty fel	yth chyl li s'cho ntn lyphul
Uth byn im ysd ibuth thin	nocuth'no Agorastocles
Yth emeneth ihy	chyrs æli choch sith naso by
U'ni id chi'l'luh ili	gubylim lasibith thym
Bo dy 'alyt'h crayn 'nyn' n'	uys'l ym'mon'cuth lusim

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The Ten Punic Lines in Hebrew Character.*

נא ית אלונים ואלונות שקָרֶת ישמכון זאת
כי מהלַכי כיון יתממו מִצלִיחים יתדברִי משכִילַי פא
קנת ית בן ית תעִיִּי† אַחי דוֹדִין בנוֹתַי
בִּעֵרָן אַרב שיחללוּהוּ מַאלוֹנִים ובִים אִיש ירדוּהוּ
בית לִי מעמוֹ תם נֻתֹּתִי יען חֵלק אנטידסמכן
ישש עֵד אֵלֶה בערמתִי פִעֵל ית חיל לִי שכֹה נֻתַּן לפֻעַל
וית בן אם יסד הביות תם מנוחתנו אנוראסטוקלים
ית אמנת יִהי קרש אֵלי חֹק זאת נשוי בִי
ועני עִד כִי הלהלוֹ אֵלֶה גבולִים לשבת תִם
בוֹא דִי עליתה אֶראֶה נא ענִין אני ואשאל אם מנוּחֹת לזים

Literal Translation of the Punic into Latin.

1. Veneror Deos et Deas qui hanc urbem colunt;
2. Ut iter (*meum*) rite consummarint, secundantes rem meam, docentes me hic
3. Repperire filium errabundum fratris mei—delectas gnatas meas—
4. Surripuit eas insidiator—quem ut-profanum-arceant a diis et in mare, unusquisque, demergant.
5. Hospitio hic donatus‡ fui apud Antidamantem—mihi cum eo quia necessitudo *fuit*
6. Grandævus ille, testimonum horum est, calliditate suâ fecit rem sibi, quam facultas dabatur ad faciendum.
7. Et filius equidem posuit domum hic habitationis suæ, Agorastocles
8. Signum veritatis erit tabula (cui Deus meus inscriptio) hæc allata mecum.
9. Et respondit testis, quod, superné, illi hæ regiones ad habitandum illic.
10. Eundo hac viâ excelsum-versus videbo nunc bivium ego; et interrogabo equidem ex ædibus egredientes.

* Vowel points have been introduced only where they seemed necessary to distinguish the sense; e.g. the conjugational vowel marks affect the sense *radically* in the word בִּעֵרָן in the fourth line, and *grammatically* in the word נֻתֹּתִי in the fifth.

† Chaldee for תעי.

‡ = exceptus fui.

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The Latin Translation, arranged Word for Word with the Punic, after the manner of the Interlinear Version of Montanus.

נא ית אלונים ואלונות	שקרת ישמכון ואת
et-Deas Deos Veneror	banc; colunt qui-urbem
כי מחלכי כיון יתממו	כצליחים יתדברי משכילי פא
consummarint rite iter-(meum) Ut	hic docentes-me rem- meam, secuudantes
קנת ית בן ית תעיי אחי	דודין בנותי
fratris mei errabundum filium Repperire	gnatas-meas delectas
בערן ארב שיחללוחו	מאלונים ובים איש ירדוחו
quem-ut-profanum-arceant insidiator Surripuit-eas	demergant (unusquisque,) et in mare, a-diis
בית לי מעמו תם	נתתי יען חלק אנטידמכן
hic cum-eo mihi Hospito*	apud-Antidamantem necessitudo (*fuit*) quia donatus-fui
ישש עד אלת בערמתי פעל	ית חיל לי שכח נחן לפעל
fecit callidate-sua borum testimonum Gradavus-illo	ad-faciendum. dabatur quam-facultas sibi, rem *est*,
ויח בן אם יסד ביות תם	מטיחתנו אבוראסטוקלים
hic domum posuit equidem filius Et	Agorastocles habitationis-suæ,
ית אמנת יחי	קרש אלי חזן זאת נשוי בי
erit veritatis Signum	mecum allata hanc (inscriptio) *cui* Deus-meus tabula
ועני עד כי חלת לו אלה	גבולים לשבת תם
hæ albi aperuit, quod, testis Et-respondit	illic, ad-habitandum regiones
בוא די עליתת אראת נא ענין	אני ואשאל אם ממטדלת לוים
bivium nunc videbo excelsum-versus hac-via Eundo	egredientes. ex-ædibus illos et-interrogabo ego;

* The collocation and construction of the Latin translation of this line, which the interlinear arrangement somewhat disturbs, will be perceived by turning to the preceding page, line 5. It runs thus—"Hospitio hic exceptus fui apud antidamantem mihi cum eo quia necessitudo fuit."

It will be observed, that the emendations of the Punic text suggested, are only two, and that they are such as do not alter the sense, the supplying in the second and third lines the suffix י frequently omitted in the Syriac dialect.

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The six latter Lines of the Passage, supposed to be Libyan, as they are found in the Pœnulus.

Ex anolim volanus succuratim misti atte cum esse
Concubitum a bello cutius beant lalacant chona enus es
Hujce silec panesse athidamascon alem induberte felono buthume
Celtum comucro lueni et enim avosd uber bent hyach Aristoclem
Et te se anche nasoctelia elicos alemus duberter micomps vespiti
Aodeance lictor bodes jussum limnimcolus.

The same divided by Interstitial Lines.

Ex alonim|uvalonus|succurat|im mitsi|atti|cu|esemacon
Cub|itum|abel|locuti|uth|beant la|lacan't|chona en|uses hui
Ec s|ilec p'ane|ess|e|athidamascon|alem in|dubert|e|fel|ono buth|ume
Cel|tum|com|ucro|lu|eni|e|ten im|avos'|duber|bent hy|ach Aristoclem
Et|tese|aneche|nasocte|li|a eli|co|s|alemus|dubert|e rm|micom|ps|vespiti
Aode|anec|'lict|or|bo|de|s|jussuml|im|nimco|lus.

The same corrected and reunited into distinct Vocables.

Yth|alonim|uvalonuth|succurat|immitsi|atti|cu|ysmacon
Chub|ythmu|abel|locuthi|uth|beant|la|lacan't|chonaen|useshui
Yeth|ilec|po|ane|yss|e|Athidamascon|alemin|dubert|e fe|ono|buth|umle
Cel|tum|com|uer|ro|lu|ani|e|tena|im|avosd|duber|benthy|Acharistoclem
Yth|tese|anechi|nasocti|li|aeli|cos|alemuth|dubert|erm|micom|ps'|vespiti
Aode|anec'|lict|or|bo|di|si'|us'l|im|mnico|lus.

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The six Libyan Lines in Hebrew Characters, with Translation.

ת אלונים ואלונות שקרת אם מצי אתי קו ישמכון*
הוב יתמו אבל לכותי ויח בינת לע לקנת חנן ושעשעי
יקת חלק פא אני ישש אתידמסכן עלמין דברת פעל אוגו ביות ומעח
חיל תם חמם וקר רע לו אני ותנא אם וסד דבר בינתי אחארסטכלם
ית טשא אנכי נשאתי לי אלי חק ועלמת דברת חרם מקם פצא שבתי
אודע אנכי עלית אראה בוא די סיע ואשאל אם מנחת לז

Deos deasque qui urbem, quinetiam iter habentem peregrinum in solitudine, tuentur ;

Gratiâ et favore consummarint luctuosum iter meum et liberos (defatigatione confectum) repperire desiderium et delicias meas (*sinant*)

Ante hac consortium hic mihi fuit grandævo cum Antidamante. Callidate aiunt fecisse habitationis suæ domum, quinetiam

Divitias hic. Propinquus et carus sodalis illi ego. Et habitationem equidem posuit fama (est) filius ejus Agorastocles.

Signum occultum egomet fero mecum Deus meus sculptura. Adolescens, fama est antiquum locum patefecit et habitationem suam.

Certiorem me faciam egomet, excelsum videbo, eundo hac qua concursus—et interrogabo equidem ex ædibus egredientem.

* By comparing the first Punic line with the corresponding part of the Libyan, it appears that the principal corruption of the latter consists in occasionally transposing the radical letters, and also substituting ש for ת.

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The six Libyan Lines arranged in separate Sentences, with the Reading and an Interlinear Version.

	mesaccon			misti		succurat	volanus	anolem	Ex
	esemacun	cu	atti	mitsi	im	scorath	valonuth	Alonim	yth
	ישמכון	קו	אתי	מצי	אם	שקרת	ואלונות	אלונים	ית
	tuentur	in-solitudine	peregrinum	iter-habentem	quin etiam	qui-urbem	Deæque	Dii	

					us			ytum	cub
useshui	chonæn	l'can'th	la	ben'th	yth	locuti	abel	ythmu	chub
ושעשעי	חנן	לקנת	לע	בינת	ית	לכתי	אבל	יתמו	חוב
et delicias-meas	desiderium	repperire (*dent*)	defatigatione -confectum	liberos	et	iter meum	luctuosum	consum -mariut	gratiâ et favore

				ess			ecs
Antidamascon	e	yss	ani	po	ilec	yeth	
אנטידאמסכן	חית	ישש	אני	פא	חלק	יקת	
Antidamante	fuit	cum-grandævo	mihi	hic	consortium	ante-hac	

tum	cel	umc	buth	ono	fel	duberte	alemin	
תם	חיל	ומצח	ביות	אונו	פעל	דברת	עלמין	
hic	divitias	quinetiam	domum	habitationis-suæ	fecisse	aiunt	calliditate	

Agorastocles	beanthi	duber	vosd	im	utena	ani	lu	ro	ucr	hhom=com
אחארכטכלב	בינתי	דבר	וסד	אם	ותנא	אני	לו	לע	ויקר	חמם
Agorastocles	filius ejus	fama est	posuit	equidem	habitationem	et ego	illi	sodalis	et carus	propinquus

choch	æli	li	nasoeti	anechi	tese	yth=eth	
חך	אלי	לי	נשאתי	אנכי	טשא	ית	
sculptura	Deus,	mecum	fero	egomet	occultum	signum	

uspiti	ps'	micom	erm	dubert	ulemuth	
שבתי	פסא	מקום	חדם	דברת	עלמות	
habitationis	suæ	dilatavit	locum	antiquum	fama est	adolescens

lez	mnico	im	uissul	si	de	bo	or'	'liet	anoche	aode
לז	מנוחות	אים	ואשאל	סיע	די	בא	אראה	עלית	אנכי	אודע
egredientem	ex ædibus	equidem	et interrogabo	concursus	hac	eundo	videbo	excelsum locum	egomet	certiorem-me-faciam

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The Punic Passage identified and harmonized with the Libyan in Sense and in Phonetic Power.

COLUMN SHOWING THE WORDS COMMON TO BOTH.

Veneror Deos et Deas qui-urbem tuentur
P. *N'yth alonim valonuth s'corath ysmacon*
L. Ex anolim volanus succurat esmacon=messecon

Rite consummariat iter-meum
P. *cun ythmu m'halach(i)*
L. *chub ytum locuti
favore

Repperire gnatas-meas dilectas
P. *caneth benothai dodain*
L. I'can't beant *eseshui
liberos delicias-meas

Di
P. *alonim*
L. alonim†

Consortium hic mihi cum-Antidamante
P. *Elech thym li Antidamachon*
L. Ilec *p' anc‡ Athidamascon
ego

Grandævus testimonium horum culliditate fecit rem
P. *yss id ele brimti fel chil*
L. ess *dubert *alemin fel cel
sermo est

Et filius posuit domum habitationis Agorastocles
P. *Uyth ben ysd buth nuchthenno*
L. Bent vosd buth *aono

Signum veritatis, Deus meus, sculptura, allatum mecum
P. *yth emeneth æli choch nasui bi*
L. et tese eli co nasocte li
occultum fero mecum

Et-respondit testis aperuit-sibi hasce regiones ad-habitandum
P. *u'ni-id il'lu ele gebulim lasibit*
L. *dubert ps'a *micom spti'i
Fama est aperuit sibi locum habitationis suæ

Eundo hac via excelsum-versus videbo bivium
P. *Bo di 'lyth§ eray 'nyn*
L. Bo de 'lict or' *si'
concursum

et interrogabo ex ædibus egredientes
P. *ugs'l mmoncuth lusim*
L. u's'ul mnico lus

COLUMN SHOWING WORDS PECULIAR TO EACH.

hanc quinetiam iter-facientem peregrinum solitarium
P. *sith*
L. im mitsi atti cu

luctuosum, secundantes rem-meam dirigentes-me hic, defatigatione-confectum
P. *mtstliahhim ythdibri mascilai pho*
L. abel la

filium errabundum fratris-mei desiderium meum
P. *yth-ben yth-thii akh(i)*
L. chonæn

surripuit-eas insidiator quem-ut-profanum-arceant a-diis, et-in-mare
P. *b'yrn arob s-y'l luhu m[alonim] ubym*
is yrduhu
unusquisque demergant

hospitio donatus-fui [mihi cum eo quia]
P. *beth noth-tho-thi [li* m'mo ihn]
L. chom ucr-ro lu eni
propinquus et carus sodalis illi ego

sibi quam facultas dabatur ad-faciendum
P. *li s- co- ntn liphal*

hic et habitationem equidem fama est
P. *thym*
L. utena im duber

erit tabula (sc.—signum veritatis erit, &c.)
P. *yhy chrs*

hic
P. *thym*
L. erm alemuth
antiquum adolescens (sc.—antiquum locum adolescens aperuit sibi.)

* The words marked thus (ˢ) are the synonimes of those above them.
‡ p'anc = po anc po = ⲡⲟ = hic.
† See the Milan Palimpsest of the Libyan lines discovered by Angelo Maio.
§ Local n.

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HERMENEUTICAL PRECOGNITION OF THE PUNIC AND LIBYAN LINES.

As ancillary to the interpretation of the Punic original, it may be convenient to premise a brief analysis of the Latin version.

In the first Latin sentence, Hanno invokes the Alonim and Alonuth, the tutelary deities of the city he had arrived in.

In the second, he prays that he may have arrived there under their auspices, and that his business may prosper.

In the third, that they may permit or grant him to recover his lost daughter and nephew, (son of his brother.)

The fourth contains, along with the reminiscence of the abduction, an appeal to heaven against the author of it.

The fifth, his reminiscence of the hospitality he had been granted there by Antidamas.

The sixth, the information he had had respecting that old man's fortunes and implied death.

The seventh, that respecting the residence there of his adopted son, Agorastocles.

In the eighth, he mentions his having brought with him, as his introduction, the Tessera Hospitalis.

In the ninth, his having been directed to that quarter of the town as the locus of Agorastocles's habitation.

The tenth, his determination to inquire further of the persons coming out from the houses.

We have thus ten Latin sentences corresponding with as many Punic lines; a congruity which suggests the inquiry, how far they mutually correspond in other respects, or rather the presumption that each Latin sentence gives the translation more or less closely of each corresponding Punic verse. As confirmatory of this presumption, the first point of agreement between them which claims our notice is, that the proper names at the close of the fifth and seventh sentences of the Latin are found at the close of the corresponding fifth and seventh verses of the original. The next is the circumstance that where common

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names are repeated in the Latin, there is found a corresponding repetition in the Punic. For example, the sentences we have alluded to, the fifth and seventh, contain each of them the Latin adverb *hic*, and accordingly the fifth and seventh Punic lines contain each the Hebrew word of same import, *thyn*. So in the sentence between them, the sixth, we have the two words of the same root, *fecisse* and *faciundum*, in the Latin, and in the corresponding line of the Punic the equivalent word of the same Hebrew root *phi'l* and *phu'l*. So much for the fifth, sixth, and seventh. In the fourth Latin sentence the word *Dii*, and in the first *Deos;* so in the Punic of both *Alonim*. In the eighth Latin sentence *Deum*, and in the eighth Punic *Æli*, (*Deus meus*) of the Gospel and Psalms. In the third *filium*, and also in the seventh. So in Punic three and seven, *byn* or *ben*, *son*. In the second Latin *ut*, and in the Punic *chi*, the Hebrew for *ut;* and so in the ninth Punic *chi*, and in the Latin *ut*, virtually, (being there commuted for the equivalent, accusative, and infinitive.) It should have been mentioned, that in the first and sixth sentences there occurs the repetition of the Latin relative *qui* in the first, and *quod* in the sixth; and that accordingly we find a corresponding repetition in the first and sixth Punic lines, that of the letter *s*, the sibilant by which in Latin characters the Hebrew relative is expressed.

These congruities speak for themselves. They show that the Punic *verses* correspond with the Latin *sentences;* they give the Punic for the several words repeated in the Latin, and show the affinity, or rather identity, of the Punic with the Hebrew and the cognate dialects.

The repetitions we have hitherto noticed are however only of words of the *same root*, let us now endeavour to extend the process to those of the *same grammatical form*. In the first, fourth, and eighth Latin sentences we have the words *Deos* and *Deas*, *Dii* and *Deum*. In the corresponding Punic line occur the words *Alonim Alonuth*, *Alonim Æl; Alonim Alonim* agreeing with *Deos Dii*, *Alonuth* with *Deas*, *Æl* with *Deus*. In the same way, for *filium* and *filias*, or *gnatas*, we have *ben* or *byn*, and *binoth*, in the third and seventh line; and in the last line but one another word occurs in *im-gebulim* for *regionibus* of the Latin in the same pennlt line. In short, to the Hebrew scholar it must be clear that *im* and *uth* are the masculine and feminine plural Punic, as we know they are masculine and feminine plural Hebrew.

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The only line not included in the above induction of corresponding repetition is the last. But it too affords exemplification of the *im* and *oth* being masculine and feminine plural in Punic as in Hebrew. For *qui egrediuntur foras* is obviously equivalent to *egredientes ex ædibus*, (the Delphin interpretation,) and accordingly as "*luz*" signifies *egredior*, and "*mnuchoth*" *ædes*, we find the Punic run—*luzim m-mmnchoth*.

Before we dismiss the subject of words in duplicate, it may be worth while to point out one or two other cases of Hebrew duplicate, not less pertinent, though less obvious, than those already noticed,—viz. repetitions of words or phrases occurring in the original, although not verbally transferred into the Latin translation. Examples of this sort occur in translations accounted literal, but are still more likely to occur in such as are only paraphrases or abridgments. And the Latin translation of the Punic is, properly speaking, nothing but an abridgment. In the sixth line we have the phrase "*aiunt*," *they tell me, they inform me, their information is.* In the last line but one, "*monstratum est*," *it has been told me, my informant, in answer to my inquiries, deposes, &c.* In both these clauses, therefore, we have in common the idea of *information, testimony*, &c., and accordingly in both we find the same Hebrew-Punic word עד, id, = *witness.*

עד, the Punic *id*, has (as *witness* has in English) the double meaning of either *witness, testimony, information*, or *deponent, informant.* עד אלה, *id elleh*, in the sixth verse, is the *testimony of these people.* עני עד, *yni id*, in the penultimate verse, is equivalent to *witness answered or deposed.* ענה עד, is a peculiar Hebrew phrase which occurs in the ninth commandment. עני עד (with י instead of ה) is an Arabism, which having the copulative ו prefixed, becomes by synæresis the *u'niid* of the Punic,* *and witness testifies.*

The word עד in the penultimate line is recognized by Bochart, but it escaped his observation in the sixth, as did also the words respectively combined with it in phrase in both lines. אלה, ele, *these*, after it, in the former; and עני, ni, *answered, testified*, before it, in the latter.

Again, as the latter section of the passage relates almost entirely to the idea of *hospitalities*, either those received by Hanno from Antidamas, or expected on

* See Schindler in verb.

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the part of his representative, Agorastocles, we may expect the recurrence of terms equivalent to *house, dwelling, dwelling-house.* Now amongst the Hebrew synonymes for such ideas are the following: בית, *beth,* מנוחת, *mnuchth,* ביתמנוחת, *beth mnuchth,* or בות נחות, *buth nuchth.** Accordingly, in the fifth Punic line, for *hospes mihi fuit Antidamas,* the first word which presents itself is *beth,* which, connected with the word *noctothi,* (for *notothi,*) in the same line, means that Hanno was granted hospitable accommodation in the *house* of Antidamas; or in the Latin phraseology of the ensuing scene, *hospitium præbebatur,* agreeing with the *domum præbente* of Horace, Sat. v. lib. 1. And in the last line, in which occurs *foras,* rightly interpreted in the Delphin edition, *ex ædibus,* we find the equivalent Hebrew phrase, ממנוחות, m-mnuchth, *from the houses.* And in the seventh verse, which, as we shall find, means, that the adopted son Agorastocles had built or fixed his residence there; the line runs—*uth ben ysd buth nuchtheno* or *beth mnuchtheno—ædificavit domum habitationis hic.* בת מנחת, *a house of rest, a mansion, a house of residence,* is a phrase which occurs in the Hebrew Scripture, and frequently in the Chaldee paraphrase.

By this copious induction of words in duplicate, we have not only elicited so many Punic vocables and their value, but have established the principle, and are entitled to the benefit of it, that the language of the passage is Hebrew, or one of its cognate dialects; and that the ten Latin sentences correspond in sense, as well as number, with the ten first Punic lines. We have therefore in the first instance the Punic mass divided into ten integral portions, each of which will be found to consist of two distinct parallel or correlative clauses. Several of these clauses become still farther decomposed by the intervention of the duplicate terms already discovered, or by the Hebrew equivalents, easily discoverable, of expressions rendered literally in the Latin, or nearly so. And as to the remaining unknown Punic expressions, their value must be elicited by bringing into juxta-position with them such Hebrew expressions as have, whether as accessories or supplements, coherence with the Latin in sense, and with the Punic in phonetic power. The accomplishment of this result, or approximation to it, should be the solution, or the approximation to it, of this interesting philological problem.

* See Plantevich's Thesaurus Synonimicus.

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Having thus taken a first view of the Punic passage, properly so called, it remains that before we pass on to the explication of it in detail, we take some notice of the six lines, commonly distinguished by the title of the Libyan Verses. Some critics have dealt with them as a continuation of the preceding ten; others have pronounced them a repetition or version of them in a different dialect. The attempts to explicate them on the former hypothesis have been condemned, I believe, unanimously as failures. Those who have adopted the latter view of them have, I think, as uniformly abandoned the attempt in despair.

One encouraging fact, however, meets us *in limine*, and one, of which the tabular matter, in the twelfth page, furnishes ocular demonstration; that the six lines are so far the duplicate of the ten, that in each of the ten Punic lines, but one,* we find a small, but significant, combination of vocables, which have their echo in the corresponding locus of the Libyan passage,—a broken sentence common to both, agreeing with the Latin in sense, and with both Punic and Libyan in phonetic power. Along with this series of duplicates in sound, we find a series equally numerous of synonimous expressions, constituting duplicates in sense. And with this common portion the ascititious or supplemental Punic and Libyan remainders cohere, as the "common Gospel" of the German critic† with the supposed additions of the Evangelists, forming a harmony of the Punic passage with the Libyan, such as is submitted in the next page.‡

* I find since this paper was sent to press, that this exception is removed by the Milan Palimpsest of Angelo Maio, in which we discover within the locus where we might expect it the word Alonim corresponding to the *Di vostram fidem* of the Latin.

† Eichorn.

‡ In reference to this harmony it would seem a proper opportunity to observe, that some of the best editions of Plautus, in place of *ysdibuth*, in the seventh line, read *ysdibur*, which may be rendered, "has fixed (report is) his residence here," harmonizing with the *voso duber* of the Milan palimpsest, as *buth·nuchth* does with the *'ono buth* of the preceding Libyan line. Again, in the penultimate line of the Punic the words *chil lu*, may be read either *chi* ח*l*א*lu, that yonder, above there, to him*, &c.; or *chi* ח*l*ל*lu, that he has opened for himself;* according to the meaning, *open—open eminently*, ascribed by Parkhurst to the word חלל. The latter reading is recommended as harmonizing with the Libyan of the same sentence in meaning; but the former having been adopted in the first instance, the corresponding Latin rendering *superne, illi hæ regiones*, &c. hold it's place still, p. 7.

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*A Harmony of the Punic and Libyan Passages.**

May the Gods and Goddesses who guard this city, [and also the lonely traveller on his way,]

Graciously = auspiciously consummate my [sorrowful] *journey*—prospering my business, directing me here

[Worn out with fatigue] *to recover my children,* the stray son of my brother—my beloved daughters [my darling—my delights,]

He swept them off, the lier in wait—whom-may-they-cast-out-as-profane from the *Gods,* and in the sea, one and all, may they sink him.

Hospitality I was granted here because *I had a connexion with Antidamas:* [a near and dear guest to him (was) I].

The old man the testimony of these people = [the report] is by his shrewdness† *acquired* a house of residence—moreover *a fortune* for himself, such as ability was given him to acquire.

And his son has established his house of residence here *Agorastocles.*

[The private] *token* of truth will be this tablet—*my God the engraving* [I have] *brought along with me*

And [the youth] *witness deposes* [= *report is*] *has opened* these quarters [the old place] for *his habitation,*

Going this way toward *the high place, I will see the Birium,*
[I will inform myself—I will see] *the high place, going this way* [*the concourse*] *and will ask the out-goers from the houses.*

* The parts in Italics are in duplicate; those joined by = synonimous; those in brackets Lybian.

† Synonimes in the original עלם and ערם, *calliditas.*

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Argument of the first Section of the Punic Monologue.

Journeying in search of his lost nephew and daughters, Hanno is represented as invoking in the first part of the monologue the auspices and guidance of the tutelary divinities of the city for their recovery, and, as we shall find, for the punishment of the Andrapodist. In the sequel of his soliloquy, we shall find him resolving to put in requisition, for the same purpose, the friendship of the son of his former host, and the appliances of federal hospitality.

The case of Hanno may be considered as one of the many cases arising out of that infamous traffic, which, from the earliest ages, may be said to have been the curse of the race of Canaan and of the continent, which contains what was called the Land of Ham. Of this traffic, one principal branch was the abduction of what were called surreptitious children,—a son, or brother's son, whose "careless childhood had strayed," or been decoyed; one or more of the beloved daughters of the house, or haply the entire flock, seized by the "lier in wait," and carried off "at one fell swoop," leaving the bereft parent to consume the miserable remainder of his days in hopeless efforts for the recovery of the lost remnant of his line, in journeys of interminable length, and of doubtful issue, begun with prayers for their direction, success, and consummation, and ending with curses upon the execrable author of his bereavement. Such, or substantially such, will be found to be the argument of the first section of the Punic monologue in the Pœnulus.

The section divides itself into two principal parts,—the one relating to the abduction of the children, including an imprecatory appeal against the child-stealer, or Andrapodist; the other relating to the journey for their recovery, beginning with an invocation addressed to the tutelary deities for success.

It may conduce to the more easy development and explication of the passage to follow the order of time, and begin with the part relating to the Abduction.

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The Punic Phraseology respecting the Abduction explicated.

Yth byn ithii ahhi—dodain benothai—byr'n arob. We shall first consider the part translated in the Latin, and then explicate the Punic for which there is no Latin equivalent.

	Gnatas meas	Fratris filium	Quæ mihi surreptæ sunt.
Latin.	Filium	Fratris	Gnatas meas.
Punic.	yth Byn	A	Bynuthii
Hebr. Chald.	yth Ben	- ahh	Benothai
	יתּ בן	אח	בנתי

This part of the clause explains itself, and requires no further explanation.

Quæ mihi surreptæ sunt, or, as it is expressed elsewhere in the play, "*surripuit eas*," (*prædo*), *he carried them off.*

In looking for a proper Hebrew equivalent for *surripuit*, we must bear in mind, that it is not simply taking away, but, taking away or bereaving of children, that is meant, *taking away posterity.* In this sense the Hebrew word most frequently used is the word *byr*, בְּעַר. It is the pihel of בער, and occurs repeatedly in that sense in the first book of Kings; *surripuit eas*, will be, accordingly, בְּעַרְן, Punic *byrn.*

For the Latin of this clause we have thus given the Hebrew-Punic equivalent. But certain Punic expressions remain for which no Latin is given, viz. :—

Between "*byn*," *son*, and "*a*," *of my brother*, Ithii, יתּעי yth thii.

After "*a*," *brother*, and before "*benuthii*," *daughters*, Doedin, דודין dodain.

Between "*byr'n*," *he carried them off*, and the following clause, Arob, ארב ar'b.

To explain these three expressions must be our next business; and first, of the expression Ithii, Yth-Thyii יתּ תעי.

Ithii, יתּ תעי *Yth th'ii*, "*Errabundum*," *the estray.*

The *nephew*, or *ben-ahh*, is, in the prologue of the Pœnulus, line 65, designated *abditivus a patre, the estray*, or *decoyed one.* So, of the snrreptitious

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child in the *Menæchmi*, we find the expressions, *aberravit a patre* in the prologue of that play; and in the fifth Act, section 9, *deerrare a patre;* the circumstance of *straying* being in both cases connected with that of *abduction*.

The Hebrew equivalent for *stray* is well known to be תעה, thyh. In the participial form, *straying*, and with the Chaldee article prefixed יתהעה *iththoeh*, or *ithoeh*. In this form the meaning would be "*filium errabundum fratris*," *the stray son of my brother*.

In the parable of the lost sheep, as given in St. Matthew's Gospel, "the one that went astray" is rendered in the Hebrew Testament את תעה. But in the 15th chapter of Job, we find the root in the passive rendered *seductus*, which in the passive participle, *pahul* form, would be תעוי thui, *decoyed;* and in the Chaldee dialect would become תעי thii; and with the article prefixed, (whether the Chaldee ית or the silent ה) ithii.* Now this is the very Punic word which, in its position between *ben* and *ahh*, was noticed above, as requiring elucidation, and which turns out to mean in that, its proper grammatical place, "the stray, or kidnapped son of my brother," ית בן יתּ תעי אח yth ben ithii ahh.

Doedin Bynuthii, דודין בנותי *Dodain Benothai, my beloved daughters.*

The little trait of boyish vagrancy and decoyed childhood which we have just adverted to, as expressed in the prologue, and thereby detected in the untranslated part of the monologue, as it gives an air of individuality and verisimilitude to the poetic picture in the latter, so it serves by the undesigned coincidence between it and the former, strongly to sustain the truth of our philology. Now, as in that clause, the adjunct "*abditivus*," *estray* or *decoyed*, so characteristic of the rambling boy, was found wanting in the Latin version of the Punic, but by the help of the prologue detected in the Punic itself; so in the clause we are next about to consider, we may suspect it owing to the Latin being defective, that we find

* Where the same consonant ends one syllable and begins the next without a vowel between them one only of those consonants is retained in the pronouncing and in spelling. And wherever in the spelling we find the consonant doubled, the two consonants must be read as with a vowel, or rather apostrophe between them, making a syllable, thus: יתּ תעי = yth-thii, is pronounced and spelled "ithii" in the third line; but שילולתו = syl'luhu, in line fourth is pronounced so that "yl'lu" makes three syllables and "l'lu" two.

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in it no epithet appropriate to Hanno's daughters, on whom his fondest affections seem so strongly to have centered. In one of the following scenes, however, (Act V.) where the fond father gives vent to his feelings on the recognition of his children, he does so by the affectionate compellation, *cupitæ et expectatæ*, the same that is addressed by an Apostle to the spiritual children from whom he had been separated—"*beloved*, and *longed for*,"—like that effusion also of excited feeling in the song of Solomon, "O beloved." In the passage last referred to, the Hebrew is *dodim*, with which the Punic word we are now illustrating in fact agrees, except that in order to correspond grammatically with its substantive, it is made דּוֹדַיִן dodain, "*dodain benothai*," *my beloved daughters.*

In reference to the Libyan version we should here observe, that there are two remarkable synonimes for דודן, *dilectus*, viz.: חנן, *gratiosus*, *suavis*; (Hebrew Scriptures, *passim*); and שעשע, *deliciæ*; (Proverbs, viii. 30.,) "I was daily his delight." We find, accordingly, in the corresponding part of the Libyan passage these two very strong expressions of affection exemplifying those duplicates in sense which we mentioned as recurring in that version.

Byrn Arob, בערן ארב *Byir'n Ar'b*, "*surripuit eos insidiator*," *he swept them off—the lier in wait.*

The next word, *arob*, signifies a *lier in wait*, and nearly corresponds with *prædo*, the pirate or andrapodist spoken of in the Pœnulus as the author of the surreptitious abduction, which nefarious object was generally effected by lying in wait for the unwary victim. By one of those liers in wait Hanno's nephew has been already mentioned as being decoyed or led astray. And of one of that class of persons it is that we read in the tenth Psalm, "He doth ravish or carry off his victims when he draweth them into his net, he lieth in wait for that purpose." Or, as elsewhere, "lieth in wait to catch men." As, therefore, the ravishing, catching, or carrying off the children, was expressed by the preceding word, בער, *rapuit sustulit*, we are not surprised to find that word accompanied by a word signifying *lying in wait* for them, ארב; "*surreptæ sunt, surripuit eas prædo*," *the man-stealer carried them off*, בערן ארב.

That the word *arob* is used in Scripture in similar cases of abduction, and exactly in a similar way, in reference either to the method or agent by which abduction is effected, shall be shown in the following clause.

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Punic Phraseology respecting the Abduction collated with the Hebrew Scriptures.

Of the cases of abduction, bereavement, or captivity recorded in Scripture, those which I shall refer to are the following:—That of Lot, the first recorded case of abduction into captivity, (a nephew too, as in the case before us.) That of Joseph, the first recorded case of child-stealing. That of the daughters of Shiloh, the first case on record of the forcible abduction of females. The bereavement of the monarchs of Israel by the taking away, or extinction, of their posterity; and, finally, the abduction into captivity of the Israelitish people.*

With respect to the first, the nephew of Abraham is designated in Hebrew as the nephew of Hanno is in Punic, *Ben—ahh*. With respect to the second, the "Hebrew Boy,"† who says of himself that he was "stolen from the land of the Hebrews," and who was "sold to be a bond servant," we find, in the account of his abduction, the circumstance previously mentioned of the child straying in the field; the same root being used for *straying* that is used in the Punic, with respect to the Boy of Carthage, the well-known root, תעה. With respect to the third case, the daughters of Shiloh, their abduction, like that of Hanno's daughters, was effected by ambush, or liers in wait; the word for *liers in wait* in the Hebrew passage in question, and in several others, being, as in the Punic, the word *arob*, ארב.‡

The remaining word in this clause to be collated with Scripture is *by'r*, בְּעֵר, the word by which Hanno expresses the abduction of his daughter and his own bereavement. With a view to collating it and the entire clause with the Hebrew Scripture, we must bear in mind what the extent of that bereavement was; and that the previous abduction of his nephew and that of his daughters left him not only childless, but without hope of posterity. This condition is one

* This case of abduction will be referred to as including passages illustrative of the *imprecation* against the Andrapodist by parallel Scripture denunciations against those who were accessory to the selling the children of the Israelites in the slave markets.

† See Sir Wm. Jones's Translation of the Persian poem of Hafiz in his Grammar of that language.

‡ See those several passages of the Hebrew Scriptures.

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frequently alluded to in the Old Testament, and expressed generally by periphrasis, but sometimes by a single and special term. The abduction of a captive, as in the case of Lot, is expressed by the word שבה, *captivum abducere*; in cases of child-stealing, as that of Joseph, by the word גנב, *furari*; forcible abduction, as in the case of the women at Shiloh, חמף, *rapere*. But in cases of bereavement, threatening the extinction of the family line, the phrases used are such as follow: "Write this man childless;" "I will cut off son and nephew, name, and remnant;" "I will bring evil upon his house;" or, finally, "I will take away his posterity."

The most general, as well as the most brief formula, is the last one. Particular instances of such extinction of the line are of course to be looked for rather in the records of royal than of private families. In those of the kings of Israel we find the following denunciations: "I will *take away the remnant* of the house of Jeroboam;" "I will *take away the posterity* of the house of Baasha;" "I *will take away thy posterity*," again addressed to Ahab. The Hebrew word for *taking away*, or *abduction*, in all these sentences being the same, the word בער. Its reiteration in the same meaning, and on similar occasions seems to imply a special and singular propriety in its application to cases of extinction of the family line. This was Hanno's case, and the word בער is the word he uses, בְּעָרָן אֹרֵב byr'n arob, "he took them, or swept them clean off—the lier in wait."

The word בָּעַר, as thus used in Scripture, must be confessed to be a word of curious felicity and of rare pith and pregnancy, and admirably adapted to express the sure, swift, and fatal effect, of an unseen destroying power. Not less, but rather more curious and interesting is its selection, adoption, and propriety of application in the case before us, a fragment of heathen poetry, the sole surviving fragment, that can be so called, of the Carthaginian language and poetry. Certainly, no other single word could have been put into the mouth of Hanno, so capable of adequately expressing the *gravamen* of his wrongs, hopeless bereavement of posterity. It is admirably in keeping with the case and the dra-

* The word *byr*, the Septuagint renders by the Greek ἀφανίζω, *to cause to disappear*, and the Latin version of Castalio, by "*abstergere*," *to sweep off*. The idea conveyed by it in the great majority of occasions on which it is used, and in which both the above interpretations agree, includes the more or less rapid *disapparition* of an object as the effect, from the operation of some violent and sweeping agency as the cause.

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matic character. The conception, it would seem to conjure up, if not definitely to convey, being that of the harpy violence of the spoiler, like some ambushed minister of the fates, sweeping off the sweets of his domestic happiness and hopes, and leaving "no remainder."*

Punic Phraseology respecting the Imprecation explicated.

Sylloho Malonim, ub'ym is yrduhu, שיללוהו מאלונים ובים אש ירדוהו,
"*Quem ut profanum arceant a Diis et in mare unusquisque demergant.*"

At this part of the monologue, Hanno's reminiscence of his wrongs calls forth against the author of them an appeal to the gods, rendered in the Latin *Di*, &c., which we may consider as an appeal to their retributive justice—in effect, an imprecation invoking punishment on the Andrapodist, or African slave-dealer of that day. With respect to the punishment to which Hanno's imprecation purports to doom the Andrapodist, we are here deserted by the Latin, but may venture to form some conjecture on the subject from certain known usages of antiquity in general respecting the disgrace and punishment of such execrable characters, and perhaps we may add, from those of the Carthaginians in particular.

It will be recollected then, in the first place, that persons attainted with the guilt of infamous crimes, such as those called Andrapodists, men or child-stealers, were included amongst those designated as βεβηλοι† and εξειργουμενοι,

* Reminding us of the expression purporting to have been dictated by parallel circumstances and feelings,

"My children too, that were most precious to me,
Hell kite, at *one fell swoop.*"
Macbeth.

And of the similar circumstances and feeling expressed by Logan, the American chief, in the words—"There runs not a drop of my blood in the veins of any human being."

"To whom nor relative nor blood remains,
No, not a kindred drop that runs in human veins."
See Jefferson's *Notes on Virginia*, and Campbell's *Gertrude of Wyoming*.

† So St. Paul, 1 Timothy, ix. βεβηλοις—ανδραποδισταις.

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and accounted obnoxious to a ban, execration, or anathema, disqualifying and precluding them from access to the gods, and the rites and privileges of religion. Thus against such a one we find in the Œdipus Tyrannus of Sophocles the following imprecation: *τον ανδρα τουτον—μηδε εν θεων ευχαισι κοινον ποιεισθαι—ωθειν δε ως μιασματος ημιν οντος.* To which head we may also refer Horace's repudiatory formula, *Odi profanum—et arceo.* According to the spirit of such passages, one of the first articles in an imprecation against an Andrapodist would run: "May they brand him as an object of abhorrence, and excommunicate him from the gods as profane." *Ut profanum arceant—βεβηλωσι απο των θεων*; יחללוהו מאלוניכם, *y'l'luhu malonim.* For, the Hebrew term for such repudiation, both in the Scripture and in uninspired writers, (as Maimonides,*) is well known. In the Holy Scriptures it is uniformly the Hebrew equivalent for the *βεθηλοω* of the Septuagint, חלל, designated in lexicons *verbum prohibitionis—abominationis.*

Moreover amongst the different punishments inflicted by the ancients, there was one which was designated Ατιμια, or *Ignominia*, another was the *Demersio.* The חלל, which we have just adverted to, may be referred to the former head; that which we are about to allude to, in which the former frequently eventuated, to the latter. It will be recollected, that there widely prevailed a custom, especially amongst the Phœnicians and their colonists, of not only desecrating such repudiated wretches, and repelling them as profane from holy rites, but further, of following it up by their demersion; devoting them, with the most direful imprecations, to be thrown into the sea. So that the latter article being included in the imprecation with the former, it would embrace two distinct clauses: first, the desecration, excommunication, or anathematizing of the offender; secondly, his ignominious and capital punishment, by publicly sinking him in the sea. Accordingly the imprecation of Hanno will be found to run, "whom may they make him an anathema from the gods, and (one and all) may they sink him in the sea."† *B'ym is yrduhu = yrtoho,* ביכם איש ירדוהו.

* Amongst the different classes of the captivity that are mentioned by Maimonides, as having gone up from Babylon, viz.:—Sacerdotes, Levitæ, Israelitæ, nati, Peregrini, Liberti, Spurii, we find the חללים, or *Profanati,* &c.

† The word חלל in the imprecatory or optative form, that is, in the future tense will be יחלל,

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Punic Phraseology respecting the Imprecation, collated with the Hebrew Scripture.

As we have thus established the identity of our conjectural reading with the phraseology of the Punic text, let us now examine how far that reading and the interpretation of it is sustained by parallel passages in the Old Testament on the subject of imprecatory appeals to heaven against those Andrapodists by bereaved parents, or denunciations against them of the vengeance of heaven, by the prophetic writers, conceived, moreover, in terms such as a Tyrian might use or understand. As the preceding clause respecting Hanno's bereavement was collated with the parallel passages respecting the threatened bereavement of the *kings* of Israel, the clause we have now to explain, the imprecation against the Andrapodist, shall be collated with such passages respecting the captivity of the Israelitish *people* as contain either their own imprecations or the divine denunciations against those who were principals or accessories "in selling their children as slaves." The passages we shall refer to are to be found scattered through the Prophecies of Isaiah and Jeremiah, the Lamentations, and Ezekiel, the principal one being in the last. The awful threatening in Isaiah, "I will profane the princes, and give Israel to the curse or execration," sounded the note of alarm which bade them prepare for the captivity. And Jeremy's "Voice heard in Rama" on the eve of their abduction,—that wild lament of the mother of Israel inconsolably bewailing the anticipated destinies of her children, was the prelude to the dirge-like and elegiac strains from the pen of the same prophet in his *threni* or *keenas*. In these we find the Israelites bemoaning themselves thus: "They laid wait for us in the wilderness;" "They took our sons (as slaves);" "Thy curse upon them." While in Ezekiel again we have the divine denunciation against the Andrapodist power that oppressed them, threatening to cast him out as profane from God, and dooming him to the death of a profane βεβηλος, חלל, or abomination, by sinking him in the sea.*

and in the plural יחללו, and with the suffix of the third singular, יחללוהו, and with the relative, שיחללוהו; in the Punic of Plautus *sy'lluhu* immediately before *malonim* מאלונים, "whom may they cast out as profane from the Alonim." So ירדוהו is the hiphil of ירד, 3rd plural Fut. with the suffix. ים = *sea*, איש = *viritim*.

* Ezekiel, xxviii. 16, and 7 & 8.

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The similarity of those curses and denunciations to the Punic imprecation, both in the tenor and in the terms of them, is very remarkable. As the circumstances which elicited Hanno's appeal to the gods, bear an obvious analogy to those which elicited that of the bereft Israelites in the Lamentations, so this devoting or giving to the curse is in another place paraphrased by a synonime, which is the very word Hanno uses, viz. חלל and חלל, from Alonim, = Elohim, "I will profane, or cast out as profane, אחלל, and give to the curse."* And this is also the very language in which runs the divine denunciation against the Tyrian Andrapodist, as already referred to in Ezekiel, "I will חלל thee (cast thee out as profane) from God," (Elohim). And in another verse of the same chapter on the same subject, "They shall profane, and bring thee down into the deep, and thou shalt die the death of a *profane person*† in the heart of the sea." As the prophetic denunciation runs, "I will חלל thee from Elohim," so Hanno's words, it will be recollected, are, "They shall חלל him from the Alonim." Still more striking and curious, and affording strong cumulative confirmation of the truth of our reading and interpretation, is the coincidence between the sequel of Hanno's imprecation and that other part of the divine denunciation against the Andrapodist in the same chapter of the prophetic word, "They shall profane חלל, and shall bring thee down, or sink thee in the abyss, and thou shalt die the death of a חלל, or βεβηλος, in the midst of the sea." In citing this prophecy against the Tyrians, Bishop Newton remarks, that the prophets Joel and Amos had before denounced the divine judgments against the same people for being accessory to the same crime, that of buying and selling the children of Judah and Jerusalem, like cattle in the Grecian market.‡ So that the words are in the Scriptures directed against a Tyrian by a prophet who of all others is supposed to have been best acquainted with the Tyrian usages and modes of expression; in the Punic used by a Tyrian, or a Tyrian colonist; in both cases pointed against the same crime Andrapodism.

* Isaiah, xliii. 28.

† This will be found the true rendering of the verse, which compare with that verse: Ezekiel, xxi. 25. אתה חלל, συ βεβηλε, "Thou profane," &c.

‡ See also the paraphrase of Grotius on Ezekiel, xxviii. 15.: "Perfectus fuisti in viis tuis," *i. e.* "Successerunt—donec cœpisti exercere piraticam."—Pol. *Synopsis.*

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The prophet threatens the Andrapodist with being *hhlled*, or losing cast. Hanno imprecates against him the same doom in the same form of expression. The prophet denounces ignominy and capital punishment by *demersion*. Hanno the same in the same words.

The quotation from Isaiah, xliii. "I will חלל, '*hhll*,' *desecrate*, and give to the חרם, '*hhrem*,' *curse*, or *anathema*," would imply that the desecration and anathema bore such a relation to each other that the one was inchoative, and the other consequent, or that the former eventuated in the latter; the beginning being desecration and exclusion, and the ending excision. In accordance with this notion, the word *hhll*, as well as *hhrem*, is very frequently followed by the particle *from*. Now as Hanno's expression runs, "whom may they *hhlel* him *from* the Alonim," so Ezekiel's denunciation is, "I will *hhlel* thee *from* the Elohim;" with which agree the well-known words of St. Paul in the ninth chapter of the Romans, "accursed *from* Christ." Moreover as the *hhll* implies *making an object of abomination*, so the curse *hhrem*, or anathema, is by some translators rendered *ad internecionem* to *destruction*, and that again being coupled with *reproach*, *execration*, *ignominy*,—"I will *hh'll*, and give to destruction and ignominy;" implies the dooming to violent and ignominious death; equivalent to Ezekiel's denunciation against the Andrapodist, (Ezek. xxviii. 7, 8.) "They shall *hhlel* thee, and they shall sink thee in the abyss, and thou shalt die the death of a *hhlel*, or *reprobate*, in the sea." Now this doom beginning with execration, and consummated by sinking in the sea, was precisely the *peripsema*, or immolation by demersion, so prevalent among the natives of antiquity, and particularly amongst the Phœnicians and Carthaginians.*

In the observations upon the word *hyyr*, we considered the feelings and circumstances which dictated Hanno's imprecation. The observations above made, coupled with the following extracts, will suggest what the prevailing *notions* were which dictated its particular form and phraseology.

"Eo errore tum omnes fere nationes erant imbutæ ut in calamitatibus aliquis

* To this usage the Biblical scholar is aware St. Paul is supposed to allude in the fourth chapter of the first Epistle to the Corinthians. May there not also be allusion to the supposed efficacy of the Lustration sacrifice by immersion, in that passage of Micah, vii. 19.—"Thou wilt cast all their sins into the depth of the sea."

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unus comprehenderetur, qui omnium nomine pœnas lueret, sic quidem id exponunt quod Paulus, 1 Cor. iv. 13."—Baron, *Prælections on Jonah.*

" Undique in omnes
Prospiciunt cursantque vias qui corpora regi
Capta trahant. Ea Neptuno trux ipse parentat."
Valerius Flaccus, *Argonautic.* lib. iv.

" Victimas etiam humanas per submersionem Carthaginienses immolarunt. Nam etiam Himilcar Carthaginiensum dux, *ικετευε τους θεους; κατα το πατριον εθος τω Ποσειδωνί πληθος ιερειων* καταποντισας.*—Geusius *on Human Sacrifice,* and Diodorus Siculus, lib. xiii. p. 207.

" Circumducebatur *περικαθαρμα* cum execrationibus et sic projiciebatur."—Petronius, *Arbiter Satyr.*, p. 149.

" Sunt qui expiatores trans caput in mare jaculabantur."—Pausanias, lib. v.

εγγεσιη Οδυσηος εμοι μενεαινον ολεθρον
οφρα με δηωσωσι δυσηχεος αγγι θαλασσης
δαιμοσιν ειναλιοις.
" Quo me diis marinis mactarent."
Cointus Smyrnæus, lib. 12. *De Sinone Iliad.*

Punic Phraseology respecting the Recovery explicated.

Chi m'hlach cun ythmu mtsliahhim yth dibri mskili pho caneth.
כי מהלך כין יתמו מצלימם ית דברי משכילי פה כנת
" *Ut iter meum rite consummarent secundantes rem meam dirigentes me hic repperire, &c.*"
That my journey duly they may consummate, prospering my business—directing me here to recover, &c.

Having thus dispatched the subject of the Abduction of the children, and of the imprecation which follows it, we now turn to that part of the section which

* A number of *victims*, not of *priests*, as it has been rendered in the Latin version.

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relates to their recovery, and to the journey undertaken for effecting it, including the business of that journey, and the previous invocation for the direction, success, and consummation of it.

The recovery, *repperire*, Heb. קנרת, gerund of קנה, Punice, *caneth*, Libyce, *can't*, or rather *lacan't—ad repperiundum*. In the eleventh chapter of Isaiah, in which God declares that he will set his hand "to recover" the children of the captivity from their abduction, קנרת, *can'th*, is the Hebrew word used for *to recover*. The same word we find accordingly in the Punic sentence corresponding with the Latin one to which *repperire filium* belongs, immediately preceding and governing the clause *yth byn*, (*ithii ahh.*) We shall in regular course consider more particularly the Scriptural authority and peculiar and curious propriety of this word as here applied—קנרת ירת בן הרתעי אח, *repperire filium errabundum fratris*.

Connected with the recovery is the journey. The word for *journey*, used by the king of Persia when he gave audience to Nehemiah, was, according to that writer, מהלך, Punice *m'lach*, being the second word in the second Punic line. The same word is used for journey in the beginning of the account of Jonah's mission to Nineveh, and occurs once, and I believe only once, more in Ezekiel's prophecies, who wrote in Chaldea. So that the geography of the word may be said to be Chaldean, and the chronology of its use in Scripture probably not antecedent to the captivity. But though its occurrence is thus rare in the Old Testament Hebrew, it is frequent in the Rabbinical writings. In Maimonides, for example, respecting the kind of prayers to be used on a journey, and the kind of journey allowed on the Sabbath, &c. In the Itinerary of Benjamin of Tudela it occurs in almost every page, being used indifferently with the Old Testament word for journey, דרך. It may be added, that Hutter, in his Hebrew version of the New Testament, more than once uses *mah'lach* for *journey*, e. g. John, iv. 6. "Jesus being weary with his מהלך, *m'lach*, &c." The translation published by the Society for the Conversion of the Jews, uses the old and more common word, דרך. In the Libyan the equivalent for *m'lach* is the Chaldee *lach*, or לך, *loc*, formed from the same root by aphæresis, as מהלך, *mhlach*, by prosthesis. According to the Rabbinical points, the pronunciation of the *m* should be suspended by the metheg, or distinguished from the re-

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mainder of the word, and the *h* not being sounded in the middle, a *hiatus* is left in its place.

For the *business* of the journey, or any other business, the Hebrew-Chaldee equivalent, most common from the days of Abraham to those of his descendants at the present day, and in use in their common letters of business, as mentioned in Buxtorf. Lectio. Hebr. German. is—Dbr. דבר, Re mea דברי את, Chaldaice יתדברי, Punice, mispronounced, *yet dibri.**

For *prosperity* or *success*, the Hebrew word most generally used is הצליח, as is well known even to the tyro in the language. It is the word, for example, used in the first Hebrew Psalm in that clause, "Whatsoever he doeth shall prosper."† But הצליח, though the most common, is not the only word for *prosperity*. Success, in the fullest sense, consisting in what is begun being consummated or completed; *success* and *consummation* are in a degree synonimous. And, accordingly, in the verse of the first Psalm already referred to, the יצליח is rendered in the cognate Arabic version by יתמם, *shall consummate*. We are not therefore surprised to find these two synonimes used in this passage in the two consecutive clauses of the second verse; the one being applied to the journey, and the other to the business of it: כי מהלך יתמו מצליחים ית דברי.

There remain three Latin words in this clause of the section, yet to be matched with Hebrew Punic equivalents; the first is the adverb "*hic*," *here*, which some various readings insert in the beginning of the third Latin line, *meas que* hic *ut gnatas*, &c., a reading which the Punic justifies, as it confirms our reading of the Punic. 2. The next is *siritis*, the verb which governs the infinitive, *repperire*, and which should have a Punic equivalent to govern the Hebrew Punic infinitive קנת, *caneth*. 3. The last is *rite*, which though apparently, as it is virtually, the equivalent for *mtztiahhm*, rather implies than adequately expresses the meaning of that word.

* According to the same analogy of mispronunciation, by which in the next scene the word sounded *datas* by the Roman slave, is by Hanno sounded *dechtas*. As in the Punic passage, fifth verse, "*nuttholi*," *I was granted*, is by Hanno sounded *nuctothi*: and as the Sicilians in the immediate vicinity of Libya deflected *Carthado* to καρχηδων, and transmitted the same pronunciation to the Greeks, as observed by Salmasius in his Notes on Cornelius Nepos, *Hamilcar*.

† The Punic metathesis to *mstyal* is agreeable to the change which the letter צ has undergone in similar words, and by which *mitzraim* and *botsra tsibi* (antimony) are frequently found changed to *mestraim*, *bostra*, and *stibi*.

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First, with respect to the local particle *hic*, given amongst the various readings; its Hebrew-Punic equivalent פֹּה, *pho*, is immediately discovered in the place where it might be expected, before קנת, *repperire*, and where it was in fact detected by the writer of this Essay before he was aware of the support of that reading in the Latin version, which confirmed the Punic reading and interpretation. It makes with *repperire* most excellent sense, and is in harmony with Hanno's subsequent prayer, that the business of his journey might that day be brought to a consummation.* Second, *siritis*, (*repperire siritis*), *permit,—favour—by divine interposition lead to the recovery*, &c. Of Hanno's journey for the recovery of his children, it is said in the prologue, *Terrâ marique undequàque quæritat, &c.*—characterizing it as a journey of search, in which the obstacle to success consists in the uncertainty of the route and point of destination. In such case the means necessary for overcoming that obstacle, and, accordingly, the objects of prayer, must be *guidance*, *direction*, and *instruction*. Thus, Æneas alludes to the guidance of his goddess mother, *matre deâ monstrante viam*; and Ceres "passioning" for the abduction of her daughter exclaims on setting out in search of her, *Quis monstrator erit.*† Now for *monstrare docere*, &c., *to direct, guide, instruct*, the Hebrew equivalent is the well known Hebrew word השכיל. In the participial form, like מצליחים, (but in regimen, before the suffix (משכילי,) it it is discovered between the word רברי, *dibari*, in the second line, and the word פֹּה, *pho*, in the third, part of it ending one Punic line, the remainder beginning the next, (as those lines stand divided in the text,) כי מהלך—יתמו מצליחם יתדכרי משכילי פה *ut iter consummarint secundantes rem-meam docentes-me hic repperire*, &c.‡

Rite itself being a religious term, may be referred to the next section, viz.

* Pœnulus, Act V. Sc. 4, line 15.

† Claudian Raptus Proserp. Lib. iii. v. 429, p. 123, Rich. Heber's edition, vol. ii.

" Where shall I seek?—What lands my darling hide?
Who'll show the prints, and be my faithful guide?"

HUGHES' *Translation.*

‡ It may be repeated here, that as the synonimes for journey are *m'lach* and *derech*; so for the *success* of a journey the Hebrew synonimes are תמם and הצליח and השכיל, and that the following are Scripture phrases respecting *a journey—make way perfect—consummate a journey—direct, instruct in the way.* So that in a Hebrew-Chaldee concordance under the word דרך, *via*, synonime of מהלך *iter*, all the above phrases and synonimes will be found.

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The Punic Phraseology of the Part respecting the Recovery collated with Scripture.

The word *rite*, Punic *cun*, is one of great significance. It is a term of tutelary worship, and, though not formally included in the invocation, forms the link and *junctura* between it and the body of Hanno's prayer; which, in this respect, reminds us of the invocation of the tutelary deities, in the 2nd Book of the Æneid, "Ut *rite secundarent*," &c.; and the still more solemn address to them in the *Carmen Seculare*, what may be considered the subject of Hanno's prayer family increase, and restauration. *Rite*—tuere matres—producas sobolem—prosperes decreta super jugandis—Romulæ genti date remque prolemque, &c.*

In praying for this reparation and family increase and prosperity, and expressing hope in, and only in, the divine tutelary favour conciliated by pious worship, the language of the 127th Psalm has a remarkable agreement with that of the *Carmen;* but particularly in an expression which seems to be in sense, and in the Chaldee version in sound, the same with the word *cun*, the Punic equivalent of *rite*. An expression which, however, from mistake as to the sense, has occasioned much obscurity to readers and trouble to commentators on the Psalms.

"It is but lost labour that ye rise up early and so late take rest, (*for*) *so he giveth his beloved sleep.*" The illative particle *for* implies, that the conclusion follows from the premises, whereas the apparent inconclusiveness is felt by the generality of readers as a *non sequitur*. The truth is, the illative *for* is not in the original, and the right way of dividing and reading the passage is, in place of including that clause in the same verse with the preceding, to make it the beginning of the following verse:—"*Duly, fitly*, he giveth to his beloved" the desiderated blessing. (As a gift that cometh from the tutelary God, and conferred on his faithful people as a reward.) This is the rendering of the Chaldee version for the word which other versions render *so*, the Hebrew כֵּן = *recte, bene* = *rite;* but, according to the Chaldee rendering, *convenienter*, and in phonetic power, (according to the dialect of that version) *cun*,† pronounced

* *Rite* joined with *prosperes* and with *secundarent*, as the Punic, *cun* כיון, with ירתמו *ythmu*.

† The drift of the lesson inculcated in the Psalm is that human industry "may plant," and human

chiun, like the first syllable of the Greek word for *dog** in the inflected cases. This is the third Punic word of the second line, and might be translated *auspiciously*. It escaped Bochart altogether, and the hallucination led to other mistakes. It is like *rite*, a term of Jewish tutelary worship; an expression of affiance in the faithfulness of the tutelary God of Israel.

Chi m'lach cun ythmu—כי מחלך כיון יתמו—"*Ut iter consummarint*,"—*That my journey duly they may consummate.*

In a journey of mental anxiety and trouble, and bodily toil, Hanno prays, that the tutelary powers may consummate his enterprise, יתמו, *ythmu*. In the 20th Psalm, fifth verse, Arabic version, the supplication to the tutelary God of Israel runs, "May he hear thee in the day of *trouble, and consummate*" thy purposed operations. The word in the Psalm differs in no respect, of root or form, from the other, except in the omission of the polytheistic plural.

מצליחים ית דברי, *prospering my business*. Whether the distinguishing the business of the journey from the journey itself may be considered as a pleonasm, we shall not stop to inquire. What is to our present purpose to remark in collating this passage with the Scriptures is, that with respect to a journey having for its object the securing, as far as human prudence could, the prospect of a family, or rather the recovering of that prospect, and preventing the line of inheritance from becoming extinct, the words of Hanno praying for the prospering of this business are, *mtsliahhim yth dbri*, מצליחים ית דברי, and that in the account in Genesis, of the journey of Abraham's servant, having a similar end in view, the words, for the *business* and the *prospering* are Hanno's words: "The servant put his hand under Abraham's thigh," we are told, "and sware

carefulness "water;" but God giveth the increase, and duly (in accordance with his tutelary character) will give it to his beloved. This sentiment would exactly be expressed if the verse were supposed to run, "Duly God will give to his beloved," not שנא *sleep*, but שגא *increase*, "*remque prolemque*." The difference betweeo the two readings, being merely the difference between a ג and נ. And when it is considered how slight, and almost evanescent, that difference is; aod how liable a ג may be supposed to the loss or accidental omission of its distinctive mark; it will not appear, perhaps, ao unreasonable stretch of conjectural criticism to surmise such mutilation or omission in the present instance, and that שנא is an *erratum* for שגא, "*crescere*," *increase*.

* The Hebrew כֶּן, as io the accusative of χήν, *goose*; the equivalent Chaldee כיון, as in the accusative of κύν, *dog*; Socrates' oath, μα κύνα κατὰ χήνα.

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to him concerning that *matter* or *business*," *super hac re*, in the original, דבר. And in the prayer of the same person for the *success* of his undertaking, his words are, "O Lord God of my master, if thou art *prospering*," &c. מצליח, *mtzliahh*.*

Let us now look into the account of Nehemiah's journey. In it, we have already remarked that we find Hanno's word for journey is the one used by the Persian monarch. Nehemiah, moreover, we also find, in praying for the success of it, *prosper I pray thee*, uses Hanno's word *n'*, נה, and for *prosper* and for *business*, he (as well as Abraham and his servant) uses Hanno's word *htzliahh* and *dbr* ; *hlztiahh* twice, both in the end of the first chapter before his journey, and after it at the end of the second, when he expresses his confidence that God would prosper it, (*htzliahh*), in reply to the adversaries who tauntingly demanded of him the business of his journey, "*Quænam est hæc res*, dbr דבר, *quam facitis?*" *The God of Heaven*, he answered, *He will prosper us*, יצליח.

But there is another word of Hanno's prayer used by Nehemiah in his. We have noticed the circumstance of Hanno's being a *journey* and *business*, of *search* and *recovery* ; and that, consequently, as a means of speeding it, he prays for guidance or *instruction*. Such a journey, one of search and uncertain route, was that in the wilderness, and one which required, and obtained, the same desiderated interposition of Providence. In commemorating which—(the guidance afforded the Israelites)—Nehemiah notices, not only the outward guidance of the fiery pillar, but God's giving his Holy Spirit to *instruct* the travellers. Nehemiah, ix. 20. Hanno's word is משכילי, *instructing me* ; Nehemiah's להשכילם, *to instruct them* ; the one the participle, the other the infinitive or gerund. So in Psalm xxxii. the divine promise recognizes this peculiar aid as desirable in a journey, "*I will instruct thee in the way that thou shalt go*," אשכיל.

The last word of Hanno's prayer which remains to be collated is *caneth*, "*repperire*," *to recover*, Isaiah, xi. English version, Hebrew קנות.† By that word we may consider Hanno expressing the end and object of his enterprise, as a kinsman, to redeem his relatives from slavery, as their champion to rescue, or liberate, them from exile and oppression, and as the pious father to recover them as his posterity, the lost remnant of his line. Now when Nehemiah speaks of his redeeming his kinsmen, the Jews, who were sold

* Gen. xxiv. 42. † Root קנה.

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to the heathen, he uses in that capacity the word קנינו, *caninu.** When Moses, by whose hand the Israelites were rescued from bondage, speaks of their forgetting their divine champion who had liberated them, he says, "Is he not thy father that *canah'd*—redeemed thee?" קָנֶךָּ. Finally, when the Father himself of the families of Israel solemnly announces, by his prophet, his gracious purpose of addressing himself to the fulfilment of the promises respecting the restoration of the exiled and captive Israelites, Isaiah says, "He will set his hand again the second time to recover, קנרת, *can'th*, the remnant or remaining posterity of his people that shall be left, like as it was to Israel (on the occasion last mentioned) when he came up out of Egypt." Besides, therefore, the other passages we have referred to for some of them, we have thus found in the account of Nehemiah's journey alone, all except two of the words used by Hanno in the part of his prayer respecting the consummation of his journey, the success of its business, and the guidance and direction required for finding and recovering his children—*m'lach—mtslyahhim yth dbri msklai caneth*—as we before traced his words in the Scriptures relating to cases of abduction, and on those bearing on the curse and divine denunciation against the Andrapodist.

At the conclusion of the part respecting the abduction, we enlarged a little on the pith and pregnancy of the word בְּעֵר, *bier, byr*, of the Punic, as specially applicable to cases of bereavement, such as Hanno seemed threatened with—the abduction of his entire posterity. In concluding the part now before us repecting the Recovery, we should not do justice to the felicitous adaptation as correlatives, of the Punic-Hebrew words for *abduction* and *recovery*—"the carrying away into captivity," and "the redemption thence," if we did not remark, that as בְּעֵר was found to include not merely bereavement, but threatened extinction, so קנרת, as used in Isaiah, xi. is clearly intended to apply to the recovery of not merely the lost, exiled, or captive members of a family, but the apparently lost remainder—the entire stock, "name and remuant," in the direct and collateral lines.†

What has been said of the Punic *m'hlach, ythmu, can'th, ben*, &c. applies to the Libyan *locut, ytum, can't beant, &c.* of the same roots. Immediately before *locut, journey*, stands the Libyan "*abel*," *sorrowful*, Gen. xxxvii. 35, "I will go down to my son sorrowful," אבל, *abel;* Psalm, xxxv. 14, "Like one sorrowful, אבל,

* Same root קנה. † See the entire passage, Isaiah, xi.

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abel, for his mother." Before *I'cant* comes in the Libyan "*la,*" *worn out, afflicted.* It is a word common both in Hebrew, Chaldee, and Syriac. It occurs as fatigued and worn out after a journey and after a flight. In the latter connexion in Deuteronomy, xxv. לעי; in the former, in reference to our Lord being weary, *lah,* לאה, after his journey, (John, iv. 6.) There occurs in the Talmud the proverbial expression, "non laborans non comedens," like that of the apostle, "He that does not work, should not eat," לא לאי לא לחם; in this expression the Chaldee for *laborans* is לאי.*

The natural pathos of this parenthetic expression of despondence is obvious. It is introduced, moreover, by a beautiful and artful *junctura* in the Libyan Invocation, which, as we shall see when we come to explicate that passage, includes the traveller with the city as under the divine tutelary protection.

The Invocation.

The Plautine Latin translation of the Invocation is at once spirited and literal, and properly rendered into Hebrew-Chaldee, gives the Punic line of which it purports to be the translation. And in the greater part of the line interpreters agree. Little, therefore, need be said by way of explication, but to remark that from this perfectly literal Latin translation Bochart, misled, it would seem, by his own erudition, elaborately deviated. Having discovered in the Arabic language a word *corah* similar in meaning to the Greek χωρα, and somewhat similar in sound and spelling to the Punic *corath,* he was tempted to adopt the reading *corah,* and the rendering *regionem,* in defiance alike of the Punic reading, which is not *corah,* but *corath,* and of the Latin rendering of Plautus, which is not *regionem,* but *urbem,* the well-known meaning of *corath* in the Hebrew Scriptures. A word, than which none can be more in keeping in the mouth of a native of Carthage, and a worshipper by descent and religion of the tutelary god *Melc-Carth,* and engaged in the act of worshipping the tutelary divinities of the place.

* לאה *lah,* seems obviously the derivation of the Latin, *lassus;* French, *las,* &c.

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Job, xxix. 7, "When I went out of the gates near the *corath*, city." Prov. viii. 3, "Wisdom crieth at the entry of the *corath*, city."

Corresponding with the words of the first Punic line are those of the Libyan, with this difference, that immediately before the Libyan word *messecun* = *essemacun*, corresponding with the Punic *isimacon*, we find the clause *im* (*misti* =) *mitsi atti cu*, which will be found parenthetically to include the traveller as well as the town under the guardianship of the tutelary powers: "*im*," *moreover*; "*atti cu*," *the lonely or bereft stranger*; "*mitsi*," *journeying* or *on his way*.* The two principal words, *atti* and *mitsi*, both occur in the sixteenth chapter of the first Epistle to the Corinthians, fourth and twenty-second verses.†

Argument of the latter Section of the Punic Monologue.

Having invoked the divine favour and divine vengeance, Hanno now bethinks him of human aid, and of putting in requisition the services of Agorastocles, his old host's adopted son, and presenting to him as his introduction the *Tessera Hospitalis*.

The federal and hereditary hospitality of the ancients would seem to have had for its object to secure the hospitable reception and accommodation of travellers against the fickleness of private friendship, the fluctuation of international wars, and the changes and casualties of fortune and mortality. The covenanting individuals died, but the connexion and their beneficial interest in it vested in their representatives. Until the family on either side became extinct, and so long as either of the parties was in possession of a residence and establishment to qualify him as host, the other, on producing the hereditary tessera, was recognized as a guest, and helped as a friend. If we suppose one of the parties to such an hereditary contract on arriving in a town, to address to himself, or one of his attendants, the reflection that by virtue of it he had formerly been

* See the lexicons, Schindler, Castello, Giggeius, &c.

† The collating of the Invocation with the Hebrew Scriptures being for the reasons above alluded to, not requisite for further elucidating or confirming the explication of it, is reserved with other matter for the conclusion of this paper.

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granted hospitality there, that the accounts he had were, that the old man had died in opulent circumstances, and that the son, moreover, had established his residence there, that, though personally unknown to him, he himself had brought as a token of truth the tessera along with him, and that he had been informed on good authority that in those quarters his friend's habitations lay, resolving to proceed that way to the high place, where he should see the Bivium or square, and make inquiry of the persons going out from the houses ;—we shall have nearly to the letter the remaining part of the Punic Monologue. This we now proceed to consider.

In explicating the passage in detail we must bear in mind, that on the principles laid down in the preceding paragraph, our traveller will, in reference to former hospitalities, felicitate himself, not simply on having received them, but received them in virtue of *federal* connexion which insured to him the benefit of them in future. In allusion to the death of his personal friend we will allude, not merely to his having died but having died rich. In allusion to his heir not merely his being *here* in the town, but having a house and establishment here ; and his reference to the tessera would go to imply, not merely his *having*, but expecting to *use* it as a token or ticket of introduction.

It may be added, that on reaching the quarter of the town in which was situated the residence of his friend, his most direct way of obtaining information and assistance would be to appear upon the Bivium, or High Place, at the head of the Bivium, where hospitable and wealthy residents accosted and invited strangers who had no fixed host; and to which strangers looking for their hereditary hosts resorted to meet and be recognized by them.

It may clear our way, moreover, to observe here, that the Punic may be divided into three triplets, (besides the Invocation which takes up the first line). The first triplet includes the journey and prayer for its success, the recovery and abduction of the children, and the parenthetic imprecation. The second triplet refers to the hospitalities Hanno had enjoyed in the house of Antidamas, to the information he had of his son and heir having also set up house in the same city, with a parenthetic line between respecting the old man's fortunes and decease. In the third triplet the penultimate line alludes to the quarter of the town he had arrived at as the locus of the young man's residence, and the last, to the very street of it, which he proposes to proceed to, with a parenthesis in this triplet also

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respecting the *Tessera hospitalis.* So that of the six lines which the section now before us takes up, two are parenthetical, one relating to the fortunes of the old man, and another to the Tessera. Of the other four, the first pair relate to hospitality—the second pair being Ichnographical. If we begin with the former and end with the latter of the parentheses, the remaining two couplets will have a continuity of connexion rendering the sense more easily perceptible, as follows: "Here I was formerly granted accommodation in the house of Antidamas because of my connexion with him as guest and favourite friend. His son, moreover, has fixed his house of residence here. And witness deposes that he has occupied those quarters yonder as his habitation, and opened the old site. Going this way toward the high place there, I will observe the Bivium (the concourse,) and will make inquiry of the persons going out from the houses."

The Punic Phraseology respecting Hanno's deceased Host explicated.

> "*Eum fecisse aiunt sibi quod faciundum fuit.*"
> *Yss id elch brimtiphil yth chil li sco ntn liphul.*
> *Ess alemin dubert fel cel.*
> ישש עד אלה בערמתי פעל ית חיל להי שכח נתן לפול
> *Grandævum testimonium* (*sermo*) *horum est calliditate sua fecisse rem sibi quam facultas dabatur ad faciendum.*

It has been already shown, under the head of Duplicates, that the Punic equivalent for *aiunt* is *id ele,* עד אלה, and for *fecisse quod faciundum ; fel* s, liphul.* For *sibi* the Punic is either *lu* = the Hebrew לוֹ, or, as here, *li* = the Chaldee לְהִי. The only remaining Latin word in the line is *eum*, meaning, obviously, the old man as distinguished from the son—the *filium* of the next line. Now, in the Hebrew Chaldee synonymy, as זקן signifies *senex*, and שב *canus*, so ישׁ signifies *grandævus.* The last is the word adopted here :† and with perfect propriety and accordance with the facts of the story. For, subsequently to the

* *Fel* both in Punic and Libyan.

† Both in Punic and Libyan, in the latter spelled *ess.*

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time of his being Hanno's host, Antidamas had become the purchaser of the boy, Agorastocles: Antidamas, being then a rich old man but having become at the period of Agorastocles' adolescence and his own death very old and very rich.

Having thus gone through the part of the Punic which corresponds with the Latin, we must stop to remark that this Latin verse is elliptical and obscure; and, that in order to fill up the ellipsis, we must endeavour to ascertain what it was that Antidamas did, or accomplished, to which the words *fecit* and *faciundum* refer. It was exactly what has been last hinted at, viz.: his having not only lived to a great age, but as long as he lived continued to amass riches, which he is said to have bequeathed to his adopted son, Agorastocles;—*adoptasse eum in divitias.* To complete the ellipsis on this principle we should insert some such word as *lucrum; grandævum illum, testimonium horum est, fecisse lucrum sibi quod faciundum fuit.* Certain it is, that one of the most common Hebrew words for riches is חיל *chil*, and that *chil* חיל,‡ or rather יתּ חיל *yth chil*, immediately follows the equivalent for *fecisse*, and lies between it and the equivalent for *faciundum; facere* being here, in fact, equivalent to Horace's *rem facere.*

That the phraseology פּעל חיל and עשׂה חיל, is that of the Hebrew Scriptures will be shown presently. For the present let us proceed to the two Punic phrases that remain besides those already elicited, viz: *brinti* and *cont.*

If we are right, as I think the Hebraist must concede, in assigning to פּעל חיל (*phil chil*) the sense of *rem facere, lucrum facere*, then *fecisse lucrum quod faciundum fuit* must be understood to mean *fecisse lucrum pro virili suo, summa ope*, in Scripture idiom, *according to his ability;* "as of the ability that God giveth;" or, as in a passage very like this one in the antithetical repetition of the word *do*,—Eccles. ix. 10. "Whatever thy hand findeth to *do*—do (*with thy might*), Hebrew בּכחך with thy *cohh. Fac quod assequitur manus tua ad faciendum—facultate tua*—as *cohh* has been given *s-co-ntn* שׂכח נתן לפעל, which exactly gives the last expression in this line.

Of the explication we have offered of *co-ntn* and shall offer of *brinti* confirmation strong will develope itself when we come to collate the line with parallel passages of Holy Writ. But with respect to the remaining unexplained expression we must first observe, that as money-making is the principal subject matter

‡ In the Libyan spelled *cel.*

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of this sentence, and as two qualities principally conduce to that object, diligence and shrewdness, and as diligence seems here expressed by the periphrasis of making a fortune such as means were afforded of making, so we may anticipate that the remaining quality, shrewdness, should be alluded to in the remaining expression *br'mthi*. The subject we have remarked is money-making. The speaker, be it remembered, is a Carthaginian (*loquitur Pœnus,*) of whom their countryman, St. Augustine,* states, money to have been ever uppermost in their thoughts, and whom also Cicero† characterizes as possessing eminently the quality which fitted them for success in the pursuit, *calliditas* or *shrewdness*. One of the principal expressions for this quality is in Hebrew ערם, in Arabic the synonimous and nearly similar word עלם. Of these the Punic adopts the former, the Libyan the latter. The Hebrew word with the particle ב prefixed, בערם, *byrim*, is, in fact, a Rabbinical and Hebrew phrase, Joshua, ix. 4, Exod. xxi. 41. It is in the Targum paraphrased by חכמה, *wisdom*, (and *vice versa*), *as a good quality*. And in a good sense as synonymous with חכמה, *wisdom*, it occurs in the Proverbs, "I, Wisdom, dwell with ערם, Prudence." In short the whole line runs as follows:—"The old man, the testimony or report of these people is, by his ערם *shrewdness* made the fortune for himself which ability or means were afforded him of making.

The Punic Phraseology respecting Wealth, and Shrewdness, and Success, in acquiring it, collated with the Hebrew Scriptures.

In collating this Punic line with parallel passages of Scripture, we must recollect that, as ערם, *calliditas*, and חכמה, *sapientia*, are in the Hebrew and in the Targum used as convertible terms, so Isaiah (xliv. 4,) uses the Hebrew

* St. Augustine refers to the story of the mountebank who undertook to discover in the Carthaginians each man's inclination and thoughts, and redeemed his pledge by pronouncing of them all, "*Vili cultis emere et care vendere.*"—De Trinitate.

† In that passage so frequently quoted, "*Nec numero Hispanos, nec robore Gallos nec calliditate Pœnos, &c.*"—De Repub. Arusp.

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פעל, our Punic *phl*, as synonymous with עשה; and the Arabic* version frequently substitutes the former (Hanno's word) as the equivalent of the latter. In placing the Punic and Hebrew in juxta-position, we shall do the same, putting for חכמה, ערם and עלם, and for עשה, פעל.

Thus in the two passages of Scripture most deserving our attention as elucidating the Punic—Ezekiel, xxviii. 4. "With thy wisdom, thou hast gotten thee riches." Deuteronomy, viii. 18, &c. "He hath *given thee power* to get wealth," we substitute for the first of the following readings the latter:

בחכמה עשה חיל and נתן כח לעשה—בערם פעל חיל and כח נתן לפעיל.

To say nothing of *yss*, ישש, applied in Job and elsewhere exclusively to persons of Antidamas' age, let the Hebraist glance at those two passages and at the Punic together, and he will perceive that with very slight alteration the substance and language of those two passages, along with the Hebrew expressions, for which there is equivalent Latin, as already noticed, make up altogether Hanno's verse, and that, if we may so speak, Ezekiel, Moses, and the author of the Proverbs, when speaking of money-making, shrewdness, diligence, and success in the pursuit,—in short on Hanno's subjects, speak in Hanno's language and phraseology: and that—*by wisdom to get wealth*—בערים פעל חיל, "*byrim phil chil*," *power given to get wealth*; כה נתן לפעל חיל, *co' ntn lphul chil*, are phrases common to the Syrophœnician Gentile and the inspired Jew.

Nor will it be considering the words too curiously to remark, respecting the phrase, *by his shrewdness or wisdom*, the rare fitness of its collocation between the two expressions conveying the ideas of lengthened years on the one hand, and accumulated riches on the other; connecting prudence with wealth as its effect, and with lengthened years as its cause.† On this subject it will be recollected in passing, as noticed by a late Most Reverend and eminent Orientalist in his remarks on Job,‡ respecting the word ישש, that Chappelow well hit off its meaning as not merely implying age, but the wisdom which should accompany it. Little, probably, did the author of that criticism surmise, that it would find its strongest sustentation—*quo minime reris*—from this Punic passage and the Libyan version of it rightly understood.

* Psalm, vii. 4. and xv. 5.

† בישישים חכמה, Job, xii. 12.

‡ Magee on the Atonement, Note.

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Respecting the word ישש, which Archbishop Magee dwells upon in reference to the antiquity of the book of Job, it does not appear to have been observed, that the only other book of Scripture in which it occurs, 2 Chron. xxxvi. 17, dates subsequently to the captivity. Whether, coupled with this drawback, its occurrence in the book of Job may weaken the argument for its antiquity, or strengthen it, by referring it back to that common radical language used by Abraham and his early descendants, which comprehended as Michaelis suggests, Syriac, and Arabic, as well as Hebrew, is a discussion on which it would be foreign to our purpose at present to engage.

With respect to the passage from Ecclesiastes, ix. 10, referred to in passing, we may here observe, that as the monition it contains, to "do what is to be done, or what we can do, while we have might, or with all our might," serves to introduce the memento, that "there is no work or device in the grave," so the intimation of Antidamas having acted on the principle of making or accomplishing what he could, while he lived, may be, as it has been, considered an Euphemism, implying that he had died. But as the Libyan passage, though corresponding with this Punic verse in other respects, has nothing corresponding to the words, *s' co' ntn l'phul*, in which the supposed euphemism lies, it may be doubted whether any euphemism in a positive sense of periphrasis was intended at all.

In other respects, as has been said, the agreement of the Libyan account of the man's fortunes with the Punic is very satisfactory. The Libyan *ess, fel*, and *cel*, old are obviously the Punic words *yss, fel, chil*. The Libyan *duberth*, from דבר, "*sermo*," *report*, corresponds with *id*, עד, *testimony*; and finally, the Libyan *Alemin*, root עלם, is strictly synonymous with the Punic *brimth*, root ערם, both signifying *prudence, shrewdness, wisdom*, both in the Koran and in the Arabic version of the Bible, עלם, as well ערם, are used sometimes for wisdom in the good sense. Thus in the Koran, "We have no עלם but what thou hast taught us," and in the Holy Scriptures, Psalm xix. 3, and Tim. iv. 6, are referred to by Castello. But frequently the Arabic word עלם, is like the Hebrew ערם, used to express the acuteness, subtlety, or wisdom of the serpent. The question in the third chapter of Genesis, "who told thee, &c." in reference to the temptation of the serpent, that the forbidden fruit was of efficacy to make one wise, is in one of the Arabic versions, "Who did עלם thee, &c. who has made thee so wise."

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The word is moreover sometimes used to designate divination and the kind of knowledge attributed to magicians. Indeed the name of the magician or sorcerer, in the Acts of the Apostles, *Elymas*, seems derived from עלם.

Punic and Libyan Phraseology respecting the Hospitality of the Ancients explicated.

Hospes hic mihi fuit Antidamas.
בית לי מעמו תן נתתי יען חלק אנטידסמכון.
Byth li mymo thyn nothothi iyn elech Antidamas chun.
Yeth ilec po'ni Antidamascon hhom ucr ro' lu ani.

The leading idea in this verse is Hospitality, including both the *jus hospitii*, or federal hospitality of the ancients, and also hospitable entertainment. Some light is thrown upon the phraseology applied to both meanings by that of the ensuing scene, and by the more technical phraseology also of federal hospitality preserved in the copies still extant of Tesseræ and such documents. With respect to common hospitable entertainment, Hanno's hereditary host, on recognizing him as his hereditary guest, says, "*ergo hospitium hic tibi præbebitur.*" According to which form of expression, Hanno's reminiscence of the hospitalities afforded him would run in Latin—*hospitium hic mihi præbebatur ;* or according to Horace's phrase in the fifth Satire, lib. i. "Muræna præbente *domum*," *Domus hic præbebatur* (= *hospitio hic exceptus fui*) *&c.*, but in the Hebrew or Oriental idiom, *hospitio—domo donatus fui*, which reduced to Hebrew, will give *beth—thyn nuttothi*, בית תִּן נתותי.* Words which, I need not add, are immediately detected in the Punic. Thus we find the Latin, although a fair and spirited, is by no means a literal translation of the Punic. The Libyan and Latin are here much nearer to each other. By reference to the Libyan tabular matter, and the

* On the pronunciation *noctothi* for *noththothi*, like *yctdibiri* for *ythdibri*, in a former line, and like *dechtas* for *datas* in the following scene, it is intended to offer some remarks in a note at the end of this paper.

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Latin and English translation of it, it will be perceived that the part corresponding with the Plautine Latin, *Antehac hospes hic mihi fuit Antidamas*, is rendered as follows: "*Antehac consortium hic mihi fuit cum Antidamante; propinquus et carus sodalis illi ego.*" *Heretofore I had a hospitable connexion with Antidamas; a near and dear guest to him was I.* Or, as it might be rendered, "*Hospes et carus sodalis illi ego,*" *I was his guest and favourite boon companion. Ycth ilec po ane, &c. Com ucr' ro' lu ani. Po*, the Punic *pho*, Heb. פּה, *hic.** *Ycth* = *ycs* = Arabic وقت, wkth, *a watch or clock—καιρος, tempus, tunc, aliquando. Ro*, Heb. רעי, "*sodalis,*" *a companion—boon companion; ucr*, Arab. وقر, "*charus,*" *favourite. Com*, or *hhom*, חם, *propinquus, qui tua cura* = *clientela ducitur,—a guest, an object of hospitable care.*†

So much for the idea of common hospitality, which is all that is expressed by the Latin, and which in the original Libyan runs—"Heretofore I was here the guest and favoured companion." In the Punic—"Hospitality—hospitable accommodation—lodging here I was granted." The Scripture reference and parallelism will be considered in the next paragraph. But the other view of the word *hospitality*—the federal sense of it, remains first to be disposed of.

That in this line, federal as well as common hospitality is implied, though not expressed, the mention of the Tessera in the antipenultimate line warrants us in assuming. The phraseology in which it is expressed, the ensuing scene, together with the Tesseral inscriptions and other classical *subsidia*, will assist in detecting, and our Scripture references in illustrating and confirming. In the next scene, connected with the mention of the *Tessera Hospitalis*, we meet the significant words, *mihi cum eo*, a phrase which will be found almost appropriated to federal hospitality, both in technical and colloquial usage. It occurs constantly in the old inscriptions on the Tesseræ.‡ And in Cicero's Letters, in reference to the persons with whom he sojourned or invited during his exile, we frequently meet the phrase *mihi cum eo quia necessitudo*, which rendered into Hebrew, give לִי מעמוֹ יען חֶלֶק; Punice, *li mymo iyin elech*; the *ipsissima verba* of this part of the Punic passage. לי, *mihi*, מעם *cum*, particularly used in contracts and sponsions;§ יען is the illative particle, corresponding with the conjunction

* See the *Recovery*.

† See the Arab. Lexicons.

‡ See Thomasssin on the Tessera.

§ 2 Sam. xxiv. 21. Job. xxxiv. 33.

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quia, &c. חלק,* the appropriate expression, corresponding with *κοινωνια, μερις, consortium, participatio,—fellowship = necessitudo, &c.*, literally, as in the Vulgate, *pars;* whence our English version expresses it in different passages, some of them having reference to the fellowship of hospitality, in place of having connexion or no connexion—having *part* or *no part* with the persons alluded to. Examples of this will come more fitly to be noticed in collating with the Hebrew Scriptures. It may be observed, for the present, that as in the Hebrew versions of the *New* Testament, the equivalent for *part* is חלק, so in both New and Old Testament the same word occurs with עם and מעם.† The notes in Poles' Synopsis explain the expression by making *pars* equivalent to *commercium:* "Hebræa erat formula sive proverbialis locutio quâ negabant *sibi cum aliquo* futurum commercium." Comparing this part of the Punic with the Libyan, we find the significant word *elech*, or *ilec*, implying federal hospitality common to both, but in the Libyan placed at the beginning, as in the Punic at the end of the sentence, for the same reason however, as being the most important and cardinal expression. We shall also find that between the expression for the federal connexion of hospitality and the exercise and participation of it on the part of host and guest, there intervenes in the Libyan the account of the old host's subsequent fortunes. A peculiarity of the Libyan, which is pointed out the rather as being a justification of the arrangement proposed and acted on of treating the Punic line on that subject as a *parenthesis;* which arrangement had been made before what had been dealt with as *virtually* parenthetical in the Punic, was proved to be *formally* so on subsequently examining and comparing that passage with the Libyan.

* חֶלֶק, as חenoch is pronounced and spelled *Enoch*, so חelech—*Elech*, the ח being left mute.

† 2 Sam. xx. 1 Kings, xii. 16.

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The Punic and Libyan Phraseology respecting Federal and Common Hospitality collated with that of the Hebrew Scriptures.

The principal term used to express *Federal* hospitality in Scripture is חלק, (the Punic *elech*, Libyan *ilec* and *ileach*,) *consortium*, *fellowship*, *mutual connexion*. And the expression or, if we may so speak, symbol for hospitable entertainment and accommodation, is בית, *domus hospitium*, *house*, (the *beth* and *buth* of the Punic and Libyan.)

Divertite in domum אל בית is the phrase used by Lot to the angels as equivalent to "accept hospitality," Gen. xix. 2. And the being *granted an house*, בית נתתי, the expression used by Hanno, is exactly the phrase used to express the hospitality granted to Hadad by the King of Egypt, *dedit ei domum et cibum, &c.* ויתן לו בית ולחם.—1 Kings, xi. 18.*

In reference to *Federal* hospitality, (of a spiritual and sacramental kind,) we have in 2 Corinthians, vi. 14, 15, a vocabulary or synonymy of Scriptural expressions such as those that follow: *consortium*, *communio*, *societas*, *participatio*, *pars*,—"what *part* hath he that believeth with an infidel?" This last expression of the Apostle had also been previously used by our Lord himself with like reference to the sacramental or federal hospitality of the Eucharist, John, xiii. 8, "If I wash thee not, thou hast no *part* with me." Now the word *part* in both these instances is the word for which the Libyan and Punic *ilech*, or חelech, is the equivalent, and as such is used in the Hebrew versions of the New Testament.

As to the phrase "to me with him," we find, among other places, the parallel expression in Hosea, ii. 18, "A covenant *to them with* the beasts of the field, &c." להם עם; (a passage which Jerome explains as the type of St. Peter's vision respecting the admission of the Gentiles to federal connexion with the Jews, in the same mystical company and sacramental fellowship.—Acts, x. 9.)

And with respect to יען, i'n, *because*, it occurs in Isaiah, lx. "The spirit of the Lord is upon me, *because* יען he hath anointed me."

* Respecting the Libyan expression for hospitable entertainment, *comucro*, &c. see *Recapitulation and Revisal.*

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Punic and Libyan Phraseology respecting the Residence of the Son of his former Host explicated.

Filium prædicant esse hic Agorastocles.
Uth byn im ysd' buth thym nucuth-ennu Agorastocles.
וית בין אם יסד הבית תם נוחותנו אגרסטכלם.
Utena beanthi ym vosd duber (aono buth),
ותנא בינתי אם וסד דבר
And the son (report is) has established the residence here—Agorastocles.

Two leading ideas seem to occupy the mind of Hanno in his soliloquy: in the first instance, the success of the journey he had taken to a strange city; and secondly, as auxiliary to that success the hospitable reception he anticipated from there presentative of his deceased friend, and the favourable influence of the patronage which the relations of hospitality among the ancients included.

The benefit of *Clientela*, which he had not only prayed of the tutelary divinities of the place, but intended claiming of his host by the exhibition of the hereditary tessera, (in which, be it remembered, the Clientela was in so many words generally specified,)* depended upon the heir of Antidamas being *domiciliated* in the place. And as it is this leading idea that we observe breaking out in the expression, בית תם נתתי, *I was afforded an hospitium here by Antidamas;* (including both hospitable accommodation and federal fellowship;) so the same train of thought accounts for his enlarging on the *wealth* which Antidamas had accumulated, and bequeathed to his adopted son, as placing him in circumstances to be the representative of his hospitality as of his riches. And the same train of calculation again, we may anticipate, should lead him to ascertain not merely whether Agorastocles were *in the town*, but whether he had a domicile, *and kept up an establishment there*, of which, as his guest, he might have the benefit.

On this supposition, the purport of the seventh verse, we might surmise,

* See Thomasin on the Tessera.

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should be, not merely, "They say or report that his son is here," but "The son *has fixed his house or residence here.*" Accordingly on looking to the Latin of this line with a view to elicit the Punic reading and its interpretation, we recognize *filium* in *ben*, *hic* in *thin*, and between them and the proper name Agorastocles, "*ncuthenno*," *his residence*, one of the words which we have already found the meaning of as duplicates; and before *thin* another duplicate, viz. *buth*, or *ibuth*, equivalent to *h' buth*, *ædes*, *house*. And with the word *buth* or *nucthenno*, or both, the remaining word, viz. *ysd*, (*to found or establish*,) coheres, making the sense we anticipated as demonstrative of intended hospitality, "and the son, moreover, *has fixed his residence here*, Agorastocles."

Turning next to the Libyan of this verse, we find it confirm our interpretation of the Punic. For the change from the Punic to Libyan is one generally from the Hebrew to the Arabic form, e. g. verbs beginning with ש change that initial to ז, so *ysd* should become *vosd*. Accordingly, in the Libyan, *vosod* immediately appears, being, as the Milan Palimpsest shews, the proper reading of the word commonly read *voso*. And with it turns up also one of the synonimes for *house*, viz. *tna*, תנא.* We have thus the Libyan corresponding with and confirming the Punic reading, *tena im vosod duber beanth*, "*Moreover, the son, report is, has established his residence here, Agorastocles.*"

As to the *agreement of the phraseology of this verse with parallel passages of Scripture*, the conception seems clearly in the spirit of that demonstration of divine bounty, under the emblem of hospitality,—"Wisdom hath *builded her house*, and hewn out her seven pillars,—she hath furnished her table, &c." "In my father's *house* are many *mansions*." And the latter Scripture reference, be it observed, is coupled with the other, not merely as parallel to it in sense, but because the two emphatic *terms* in it which (according to the Syriac version) our Lord uses as indicative of the divine hospitality, are the very terms which, in the Libyan, Hanno is made to use in reference to the hospitality of his old host: viz. *aono buth*, or *byth*, אונא בית, common to the third Libyan line, and to John, xiv. 2, 22, (Syriac version.)

* Our Libyan תנא, *mansion, habitation*, seems clearly to have been considered by the Seventy Interpreters as the singular of תנאת, the word in the third verse of the first chapter of Malachi, which they translate ἐπαυλεις, *habitations*.—See Pocock on Malachi.

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The Punic and Libyan Phraseology respecting the Site and Ichnography of Agorastocles' Dwelling.

In hisce habitare monstratum est regionibus.
U'ni'id chi'l'lu eleh gblim lsibith thin.
ועני עד כי חלל לו אלה גבולים לשבת תן
And witness testifies that he has rendered the quarters of his habitation accessible.
Elem uth dubert erm micom psa uspiti.
עלם ותדברת הרם (חרם?) מקם פצא ושבתי.
The young man, the report is, has opened the antiquated (or shut up?) place and his dwelling.

As the fifth verse stated Hanno's reminiscence of his old host's house in the city; and the seventh verse his information that his friend's adopted son had fixed his residence there; so the ninth states the information he had received respecting the site of his habitation, in the neighbourhood of which he had now arrived.

The phrase with which the line begins *witness reports*, has been already considered, and shewn to be a Hebrew phrase, עני עד, *witness answered or deposed, u'ni id.* The part of it (*chi l'lu*) also has been already explained in the note, p. 17, as meaning that he had *opened*, as Parkhurst, or as Gesenius explains חלל, *rendered the place accessible;** Libyan פצא.

The Hebrew *gebulim*, גבולים, for *quarters, regions*, must be familiar to the Biblical reader; and its Libyan equivalent, מקם, *mkom;* לשבת, for his dwelling; the Libyan *spiti.*

What is peculiar to the Libyan is the very natural and significant designation of Agorastocles as the young heir עלם; and the place he had opened as the *antiquated*, or shut up place, מקם פצא (חרם?) הרם, *erm*† *mkom psa.*

As a demonstration of hospitality it may remind us of Job's, "I opened my gate towards the road—אפתח."—Job, xxxi. 32.

* See his Lexicon in Verb.

† Respecting the Libyan *Erm*, see *Recapitulation and Revival.*

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Phraseology of the last Punic and Libyan Lines explicated.

Bo di alyt'h eraeh n'ynin 'n'. Uys'l im mmnuchoth luzim.

בא די עליתה אראה ענין—ואשאל אם ממנוחות לוזים.

Eundo hac viâ excelsum-versus videbo nunc bivium ego: et interrogabo equidem ex ædibus egredientes.

Aode anec' lict or bo de si us'l im mnico lus.

אורע אנכי עלית אראה בוא די ס׳ע ואשאל אם ממנוחת לוז.

Certiorem me faciam egomet excelsum videbo eundo hac quâ concursus et interrogabo equidem ex ædibus egredientes.

To understand the untranslated part of the tenth Punic line, we must bear in mind what has been touched on in the preliminary view of this latter section, that the head of the bivium, or chief place of concourse, of the Proverbs, was the place to which strangers directed their course in order to recognize, or be recognized by those to whom the ties of common business or other connexion attracted them, and that the bivium was called ינון, *ynyn*, and the head of it the high place.

To go therefore in the direction which led to this eminence or height, that he might see the bivium, and be seen, and address his inquiries to the people passing out of the houses, in one of which his friend was supposed to reside, would naturally be the course he would resolve on. *Bo di y'lith era n'ynyn n'uys'l mmnuchoth luzim—going this way toward the high place, I will see now the bivium, and will interrogate the persons going out from the houses.*

In the Libyan, instead of ענין, *bivium*, the *place* of concourse, we have the synonime or equivalent ס׳ע, *concursus*, concourse itself.

The Libyan *bo, de, 'lict, or*, &c. will be found to correspond with the Punic *bo, di, alyt'h, eraeh*, &c. The first Libyan word of the verse *aode* will be noticed in the next paragraph.

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Last Verse of the Punic and Libyan Passage collated with parallel Passages of the Hebrew Scripture.

Bo בא, Psalm, cxxvi. 6, "*veniendo,*" *going*, (see Hare's Psalter.)

Bo בא, accompanied by a local ה, Gen. x. 19, בא סדמה בא גררה, *going towards.* So here, *bo di alyt'h*, "*going this way towards the high place,* בא די עליתה.

alyt' עלית, occurs Judges, i. 15, "*superioris tractus,*" (see the Hebrew Concordance,) *the high place*, or *ground*, in contradistinction to the *lower ground*, or *valley.* This word in the Libyan is spelled *'lict*, with the guttural χ, like *yct* and *noctothi* and *dechtas* in Punic; and *ex* and *nasocthi* in Libyan. *Di* די, is the Chaldee equivalent of the Hebrew, *zeh* זֶה, sometimes spelled דֵּי, as in the Libyan. It is used in the same sense as here in Numbers, xiii. 18, *ascendite hac*, in the Hebrew זה, Chaldee Targum דא.*

ארא *ereh*, Psalm viii. 4, *I shall see.* אֵרָאֶה *eraeh*, Psalm xlii. 3, *I shall appear;* but in the Chaldee version and Luthers, *I shall see.* Hence Hanno's meaning may have been either *I will see*, or, *I will appear upon the Bivium.* In the Libyan this word is spelled *or'*.

עינין, *yinyn*, *bivium*, Gen. xxxviii. 14, 21; *bivio*, *bivio itineris*, Vulgate and Tremellius; Arabic, *loco conspicuo;* Syriac, *bivio viarum;* Jerom, *non locus sed bivium;* Calmet, *chemin fourché*, Hebr. *a la lettre.*†

In the Libyan we find אודיע *aodeh*, *I will learn* or *inform myself*, reminding us of that verse, Gen. xviii. 21, "I will go down now and will *see*, &c. and will *know*." Our Libyan and Punic harmonized, it will be recollected, are as follows:—I will *know*, אודיע, or will *inform*, myself—I will *see*, אֵרָאֶה, *going* this way *now*, נא; which will be found to correspond in sense and reading with the Scripture passage.

* The Chaldee particle די, it should be observed, is sometimes the relative, *qui*, and sometimes the interrogative, *quis?* but never signifies *aliquis*, as Bochart translates it.

† Jerom's words in his *Quæstiones seu Traditiones Hebraicæ* in Genesis xxxviii. 14, 21, are as follows: "Non est igitur nomen loci sed est sensus sedit in bivio sive compito, ubi diligenter debet viator aspicere," &c.

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Respecting the latter clause—*mnucoth*, has been explained in the Precognition, under the head of Duplicates, ממכוחות, *ex ædibus*, equivalent of the Latin, *foras*. Before this word stands *ys'l* (*im**) אשאל, *percontabor*, "*I will ask, inquire;*" after it *lusim* לזים, "*egredientes, qui egrediuntur,*" *the persons departing.*†

Punic and Libyan Phraseology respecting the Tessera explicated.

Deum Hospitalem ac tesseram mecum fero,

.יח אמנת יהי קרש אלי חק זת נשוי בי

Yth emeneth yhi chers æli chok zth nasu bi.

Signum veritatis erit tabula, (Deus meus inscriptio) hæc allata mecum.

Yth tese anechi nasocti luח æli co'.

.יח משא אנוכי נשאתי לוח אלי חק

Signum occultum egomet fero—tabulam (Deus meus inscriptio.)

The Tessera Hospitalis, the subject of the eighth verse, may be defined as follows: *Signum veritatis, tabula cui Deus inscriptio.* Adopting this definition, the Latin verse may be thus paraphrased: *Signum veritatis erit tabula cui Deus inscriptio,* which rendered literally into Hebrew-Chaldee, will give the above Punic heading, (except the three last words.) The Libyan variation in the description *occult* (Chaldee משא) is very significant and interesting. For *tablet*, the synonimy of Plantevich and the Hebrew Bible, including the Chaldee and Syriac versions, give the synonimes קרש, *cheres*, לוח, *luhh*, and דפא *dapa*. קרש, *cheres*, the word used by Hanno, occurs in Exodus, xxvi. 18, and Ezekiel, xxvii. 6, in the latter as an ivory table: and דפא and לוח, *dapa* and *luhh*, its equivalent and convertible terms, are used in the Syriac Testament, (John xix. 19, 20,) for the τιτλος, the inscribed tablet affixed to the cross. The synonime for tablet, *luhh*, pronounced, or rather spelled, *li*, as זות, *sith*, mature consideration leads me to conclude is what is signified by the word *li* in the Libyan of this verse, rather than *li, mecum, along with me.*‡

* *Im*, אם = *equidem—nunc.* † Proverbs, iii. 21. iv. 21.

‡ It is submitted, that Bochart's word, כיוד, does not ever signify a *picture* or *figure* in any

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אלי, *Æli*, has been already noticed as the *Deus meus* of the Gospel and Psalms. For the word *inscriptio* there are in Scripture two words used synonimously, כתב and חק: Job, xix. 23, "Oh, that my words were כתב, written, printed, חק." So Isaiah, xxx. 8, "Write in a table, כתב—Note in a book, חק, &c." Accordingly the Lexicons—Schindler's, &c. give חק, *scriptura.*

The meaning of זת, *hæc*, is well known. נשוי is the Pahul participle of נשה, final ה changed to י. בי = *mecum.*

The Punic and Libyan Phrascology respecting the Tessera collated with parallel Passages of Scripture.

When Rahab demanded a tessera or token from the spies, she designated it exactly in Hanno's words,* את אמת, Joshua, ii. 12.

If Hanno's tablet be supposed (as certain other tablets having inscriptions are described by the old lexicographers) a λευκωμα, or σανις λευκη, his tessera would correspond very strikingly with the symbol mentioned in the Apocalypse, viz. a *white symbol*, or *countersign*, having his *god engraved* or inscribed in such an *occult* or secret way as to be only known to the giver and receiver of it; a *token*, moreover, of admissibility *to eat of* the hidden manna or spiritual *food.*†

sense but as a *painting* or *figuring* on a *beam* or *contabulated pannel*; nor can I discover that Buxtorf, in his Chaldee Lexicon, gives as the interpretation of כיור, *tabula cui aliquid insculpta*, as Bochart and his followers seem to imply.

* אמת *pro* אמנת, *Pagnini, Thesaurus, in Verb.*

† See Bishop Pearson on the Creed, Art. IV. (Note.) And Adam Clarke's and Hartwell Horne's remarks on the "white ψηφος" in the Apocalypse. "The original words," says Horne, "do not specify either the matter or the form, but only the use of it. By this allusion, therefore, the promise made to the Church of Pergamos seems to be to this purpose—'To him that overcometh, I will give a pledge of my affection, which shall constitute him my friend, and entitle him to privileges and honours, of which none else know the value.' And to this sense the following words well agree—which describe this stone or tessera as having 'a name written which no man knoweth saving he that receiveth it.'"

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Recapitulation and Revisal.

Such is the solution which my best consideration has led me to propose, of what may be called the Punic Problem—a problem which the scantiness of its data renders of difficult, and but for a condition attending it, which I shall presently advert to, of dubious solution;—the data consisting of a meagre abstract, in the shape of what is called the Plautine Latin, and of the Libyan version, more obscure, perhaps, than the Punic passage of which it is supposed to be a translation.

On the other hand, however, as the Punic, the Libyan, and the Latin purport to give for the same meaning a triplicate form of expression, I persuade myself that not only the problem is capable of solution, but of a solution capable of being proved to be the true one; the Latin version, with such *subsidia* as may conduce to illustrate its meaning, being made use of in decyphering the Punic as a *clue*, and to verify our reading and interpretation of the Punic, the Libyan being made use of as a test and *criterion*.

In exemplifying and applying our criterion, as the first Punic line seemed to be so plain, and its signification so generally agreed upon, as to supersede the necessity of any analysis in this Essay, we shall begin with the second.

Of the second line, the Latin indicates the *principal subject* to be a *journey*, and the *success* or *consummation* of it through the *divine tutelary favor*; and one of the words in Hebrew for journey, supplied by our lexicography, being *m'lach* (Chaldee *lac*), and in the very head and front of the Punic line, the vocable *m'lach* being found, we adopt that as the true reading. The Latin clue having led us to adopt, we next look out for a test by which to try it, a Libyan criterion. Accordingly we detect the Chaldee *lac*, or *loc*, in the Libyan *loc* [*uti*] of the corresponding line. In the same way, the next Punic vocable but one, (*ythmu*), is obviously nothing but the third person plural future of תָּתִם (Hiphil conjugation), *to consummate*, "*may they consummate, or accomplish*," and is accordingly by our Latin guide indicated as the Punic reading. And on the other hand, that reading is verified by the Libyan *ytum*=*ythmu*, cohering locally and grammatically with the Libyan *locuti*, journey, as the Punic *ythmu*

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with *m'lach*. Again, in the same verse, when looking for a term of tutelary import corresponding with the Latin *rite*, as used in the Æneid, in reference to the prosperity of a *journey*, and in reference to *family* prosperity in the *Carmen Seculare*, we find in the *latter* reference in the 127th Psalm (Chaldee version) the old Chaldee word *cun*, or *chiun ;* and in the dying song of Moses, in reference to the happy termination of the *journeying* of the Israelites, the old and poetical word *hhub*, or *cub*. And when we find that of those two synonymes one is used with the *m'lach ythmu* of the Punic, and the other with the *ythum* (=*ythmu*) *locuti* of the Libyan, we have evidence as satisfactory as the subject admits, that *cun* and *cub* are the right reading.

In the third verse, the same principles of reading and interpretation suggest and confirm the Punic reading *caneth benothai*, and the Libyan *can't benn't*, as in harmony with the Latin in sense, and with each other in sense and sound. Again, in the same verse, the expression of endearment towards his children, which the subject of that line might be expected to elicit, and the actual expression of it by Hanno in a subsequent scene, in the words "*cupitæ et expectatæ*," suggest to us the appropriate synonymy of (דודים) *dodim*, "*beloved*," (in the Canticles), and the still more expressive (שעשועי) *sheshui*, "*my delights*," (in the Proverbs.) Accordingly, the circumstance of one of these synonymes being found in the Punic, viz. *dodim*, and the other in the Libyan, clearly justifies the philoprogenitive import we have attributed to those vocables.*

The word *hospes*, in the fifth verse, coupled with the mention of the *tessera* in the eighth, suggests the idea of *hospitable fellowship :* and the Hebrew word for which Gesenius's Lexicon rightly gives *fellowship*, as the proper equivalent, is (חלק) *elech*. *Elech*, accordingly, we find in the fifth Punic line, immediately next to the proper name of Hanno's host, *Antidamas ;* and in the same sentence, with the same proper name, in the Libyan, the same word spelled *ileach*. Can this significant congruity allow us to doubt that *elech*, in the sense we interpret it, is the true reading ? With respect to the further meaning included in *hospes*, of common hospitable entertainment, we find, of the two synonymous expressions for it, one, "I was granted a house, or home," in the Punic ; the other, "I was guest and companion," in the Libyan.

* There is no legible Libyan for the fourth verse but the word *alonim*.

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Nothing can be more satisfactory than the application of our Libyan criterion to the sixth line. For the Punic *yss, fel, chil,* (*grandævus fecit rem*), we have the Libyan duplicates *ess, fel, cel:* for the Punic *brimti,* (*calliditate sua*), we have the Libyan synonyme *alem* [*in*] ; and for the Punic *id ele,* the Libyan synonyme *dubert,* both equivalent to the Latin *aiunt.* The remaining words *s* and *liphul* having been shewn in the precognition to be Punic duplicates, equivalent to *quod faciundum,* and *co ntn* being shewn to be a Hebrew Scripture phrase.

In the seventh line, *ben, ysd, nuchth, Agorastocles,* agreeing with the corresponding Libyan line in the vocables *bent, vosd, tena, Achorastocles,* so determine the reading, that any other essentially different from, or inconsistent with such reading, must be erroneous. For the Punic *thyn* of that line has been shewn to be a Punic duplicate equivalent to the Latin *hic ;* and the only remaning vocable is either *buth,* as some editions read, (and above explained, as having *nuchth* for its adjunct ;) or as other copies *dibur,* corresponding with the Libyan *duber.*

The eighth verse is in the Latin, *Deum hospitalem ac tesseram mecum fero :* accordingly we have in the Punic, *æli chots nasu ;* and in the Libyan, *æli chos nasocte.** With respect to which word *chots,* I have ascertained that it, and not *choch,* (as in the editions I used), is given in all the standard manuscripts and the *editio princeps,* as the true reading, signifying *moiety, half* (Latin) *dimidium*—a meaning expressly included in that of *tessera,* as consisting of two counterparts, tallying with each other ;† and in this sense obviously alluded to in the following scene by Hanno : " *Tesseram conferre si vis hospitalem, eccam attuli*" (*nasocte*) ; to which his host responds, " *Est par probe nam habeo domi.*" In this part of the verses, the Punic and Libyan are duplicates. In the other part of the description of a *tessera* as a tablet, constituting a true and secret countersign, they harmonize as synonymous expressions. The Punic, *yth emeneth cheres, signum veritatis tabula.* The Libyan, *et tese li* = (*luhh*) *signum occultum tabula.*

* As, for *balbeit, balbec ;* for *carthada, carchedon ;* for *yth* of the first Punic, *ex* of the first Libyan line : and for the word pronounced *datas* by the slave in the next scene, *dechtas* in the mouth of the Carthaginian ; so for *yth dibari, ycthbari ;* for *nuttothi, noctothi ;* for *nasithi, nasocte ;* for *alyt,* of the Punic, *alyct,* of the Libyan.

† Fuit antiqui moris, tesseram dari hospitibus *dimidiatam.*—*Calepini Dict. Octoling. in verb.* Tessera.

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In the ninth we have the Libyan *spiti* as *duplicate* of the Punic *sibit :* and as synonymous expressions with each other respectively, *yni yid, witness testified,* corresponding with *dubert, report is ;* חיל *rendered accessible,* with *psa opened, gubylim, regiones,* with *micom, locum.*

The agreement in the tenth has also been fully demonstrated in its place.

Thus on the one hand, the Latin, augmented and elucidated by such *subsidia* as we can bring to bear upon it, suggests to the linguist a copious Hebrew vocabulary and synonymy applicable to the purport of the sentence, supplying an apparatus of verbal and phraseological *tests* for his Hermeneutical analysis, which, on the principle of affinities, serve to detect and disengage from their state of combination the elementary ingredients of our Punic compound. On the other hand, to the Punic thus detected and elicited, some Libyan word or phrase betrays a family likeness not to be mistaken : or some outstanding synonyme which the Punic rejected, as inapplicable, is recognized as a fellow synonyme in the Libyan. The Libyan thus exhibiting, to a great degree, the same words with the Punic, differently pronounced, or the same ideas differently expressed, duplicates in sense, or duplicates both in sense and sound. In short, the criterion of our reading the Punic rightly will be, that the Punic so read will furnish the key that unlocks the Libyan.—A result not only curious, but convincing, and affording a kind of assurance in our philology somewhat analogous to that afforded by the *experimentum crucis* in philosophy.

Such unexceptionable exactness as implies exemption from what may be called fractional verbal errors, and complete exclusion of uncertainty or doubt, our Hermeneutic Theory does not pretend to ;* but to the satisfactory explanation of the philological phenomena, not only of the *unadulterated* Punic text and the Latin interpretation, but of what has been "unattempted yet," the Libyan version, it does.

* For example, the Libyan phrase *comucro lu ani,* (which appears the synonyme of the Punic *beth nothothi,*) may be read ether "a guest and dear friend," חם וקר רע, or כחם וכרע, "as a guest and as a friend," in accordance with that verse of the 35th Psalm, "*as a friend and a brother.*" In the same manner, in the eighth verse, the Libyan *li* may correspond with the Punic *by mecum.* But more probably is the Libyan corruption of *luhh tabula,* the synonime of the Punic *chyrs,* the same. So again in the ninth verse, *erm macom* of the Libyan may either be read הרם, "*the antiquated place,*" as distinguished from the well-known word, *macom-ades,* "*new place ;*"

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GESENIUS.

In my brief remarks upon the word *coreth*, in the Invocation, I purposely abstained from enlarging upon the next word, upon which I had supposed interpreters were agreed. With respect to this supposed agreement of interpretation, I have since found that I was mistaken, and that Gesenius (whose recent work upon the Phœnician language and remains was, through the kindness of the learned librarian of our University, put into my hands after my own essay had gone to press) renders this part of the passage differently. The word which I would protect, being one of the very few in the reading and interpretation of which I concur with Bochart, but which Gesenius, following Bellerman, discards, is the Punic and Hebrew equivalent of the tutelary word, *colunt*, of Plautus, used by Hanno in the same tutelary reference, as in Virgil's "*posthabita coluisse Samo*," respecting Juno's guardianship of Hanno's own city,—the Punic word *ysmacun*, root, סמך, *tueor*. In defence of the reading *ysmacun*, and the Plautine version of it, *colunt*, I would submit the following considerations.

The notions and terms of tutelary religion are not to be deemed foreign from the religious notions and phraseology of the Hebrews. By that covenant which was the foundation of their peculiar theology, God was pleased to become, by federal engagements, their God, and they became his people; he graciously pledging himself to be their patron and tutelary Deity; they being pledged to be his devoted and client followers. Accordingly of Jehovah, the Elohim of Israel, that dwelleth at Jerusalem, the holy city, it is said, they [who] "call themselves of the holy city, stay themselves on the God of Israel," as their tutelary Divinity: that being, as the Hebraist knows, the force of the word סמך here used.* In the same manner we find, in the third Psalm, David, in his character as king of the state and people of Israel, expressing himself with thankful confidence, "I laid me down and slept, I awaked, for Jehovah sustained me." In both passages, the term used being the same with that used in the Punic by Hanno in the invocation, the tutelary word סמך.†

or חרם, "*enclosed place*," in reference to the opening of it by the improving heir. See also the remarks on *dibur* in the seventh line.

* Isaiah, xlviii. 2.

† *Yismaceni* in the Psalm, is translated *sustentat* in the present tense in Junius and Tremellius,

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Now as the Israelites claimed to be under the tutelary guardianship of their Elohim, Jehovah, who dwelleth at Jerusalem, and as Jerusalem was styled the city of the great King, so the Tyrians gave to their tutelary deity the title of Melcarth, as king, patron, and protector of their city. Moreover, with respect to Carthage, the daughter of Tyre, and the mythological notions and phraseology of her people, they, too, as represented by Virgil as well as Plautus, forcibly remind us of, if they were not borrowed from, those of holy writ. As the tutelary God and King of Israel is said to have loved the gates of Zion* more than all other dwellings, so of the tutelary divinity or patroness of Carthage, the queen of the gods, we read that this city was favoured of her so highly, that she gave it the preference above all lands: "*terris magis omnibus unam coluisse.*" "In Salem his tabernacle," (or *moveable shrine*), the *ark of His strength*, from which proceeded the effluence of his awful power, and effulgence of his visible presence. So of the Heathen divinity, the poet says, "*hic arma, hic currus fuit.*" "*Tabernacolo,*" says the Italian interpreter, Fabrini, in explaining the word *currus*, "*Tabernacolo dove si portano a processione le statue de gli dei.*" "I have set my king upon my holy hill."—Psalm, ii. "From Zion," says the prophet, "shall go forth the law," or royal edict.—Micah, iv. 2. "Jehovah shall reign in Mount Zion."—Micah, iv. 7. *Ex Hierosolyma gentibus jus dicet*, in the Latin translation. So Virgil, "*Hoc regnum dea gentibus esse, jam tum tendit que fovetque.*" "The hills stand about Jerusalem: the Lord round about his people," (*circumdat*), says the Psalmist. So Homer, of the tutelary protection of Apollo: *ος χρυσην αμφιβεβηκας Τενεδοιο δε ιφι ανασσεις.*

The parallel might be extended, but more to the purpose is it to observe, that as the Latin *colunt* virtually includes the several meanings expressed by the tutelary phrases, *foveo, faveo, rego, circumdo, sustineo, tueor, tutor;* so the Hebrew root to which those phrases are, according to lexicographers and translators, equivalent, is that which we find in the corresponding position in the Punic, the word

though *future* in the Hebrew, agreeably to the Hebrew enallage noticed by Michaelis the elder in his commentary on Psalm cxxvii. 2: "He *giveth* his beloved sleep:" the future, in the Hebrew (יתן, *dabit* and *det*), implying a *wonted act*. So, though in the Latin *colunt* in the present, the Punic word is in the future, יסמכון, *ysmacun*, like David's יסמכני, but pluralized in the mouth of the Polytheistic worshipper.

* "Jehovah hath chosen *Zion*."—Psalm, cxxxii. "Dis quibus septem placuere *colles*."—Hor. *Carmen Seculare.*

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סמך, *samac;* a word of which Hebrew criticism might fairly predicate what a classical critic has of one of its equivalents, above alluded to, the Homeric *αμφιβαινω*, that it is peculiarly appropriate to the expression of tutelary influence.* And as the word *Elohim* is used both of the true God of Israel and of the false Heathen gods, so *samac* (סמך) is used in Scripture to express the exertion of tutelary influence—both *real* on the part of the true tutelary God of Israel, and *pretended* on that of the false gods of the Heathen—hoped for on solid grounds by the true Israelites, and vainly expected by those who were only so outwardly, "calling themselves of the holy city, and therefore staying (*samaching*) themselves on the *Alohim* of Israel." As in the participial form, as a noun, signifying upholder, tutelary patron, *somech*, it is said: "Jehovah is amongst my *somechim*," (Psalm, liv. 4); so it is said of the false tutelary gods of the Heathen: "The *somechim* of Egypt shall fall."—Ezek. xxx. 6. That is, as explained in Pole's Synopsis, as the Philistine tutelary Dagon fell before Jehovah.†

* "Vis verbi, *αμφιβαινειν*, eximia inest in Tutelâ exprimendâ."—*Kennedy's notes on Homer in loco.*

† I shall here take the liberty of adding the following remarks; first, on some points of interpretation in which Gesenius follows Bochart; and afterwards on some of those for which we are indebted to his own ingenuity: addressing myself to the task with unfeigned respect for that distinguished professor's learning and labours.

In the third, fifth, and tenth lines, Bochart proposes and Gesenius seconds three different amendments of the Punic, each of them by the interpolation or substitution of the same letter, *r*. Through its intervention in the third line, our Hebrew-Punic word *caneth* (equivalent to the *repperire* of the Plautine Latin) had, by Bochart, been, with the preceding *li* and *pho*, made *liphorcaneth*, contrary to the text in all manuscripts and editions. For Gesenius was reserved the adjustment, in this case, of the conflicting claims of the emendation and the text, which he effects thus. Having, on the ground of Bochart's critical conjecture, and to make the reading meet the interpretation, admitted the *r*, and taken, as it were, his etymological turn out of it, he then, to meet and obviate objections against thus tampering with the integrity of the text, dismisses the *r*, on the grounds of a critical conjecture of his own, of rather an original kind, viz. a supposed agreement, if I understand his meaning, between the Carthaginian orthoepy and the English. Gesenius' words are, "Cum Bocharto scribo *liphorcaneth*, לפרכנת, quanquam retineri posse censeo *liphocaneth* sine *r* quod Pœni, in pronunciando subinde omisisse videntur ut Angli in *horse*." In the fifth line again, by the help of the *r* power, our Punic *byth-li-m'-mo-thyn* is transformed, to meet the interpretation, into *beterem muth*, &c., but this emendation, being contrary to all authority, and leaving the original word scarcely recognizable, the authorized reading, *byth-li-mmo-thin*, &c., is like the vulgate *lipho caneth* allowed to keep its place to the eye and the ear, though not backed like it by the same high

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Respecting the parenthetic part of the Libyan Invocation, purporting to include the bereft stranger travelling on his way, as under the protection of the local tutelary deities, it may be observed, that it is not only in accordance with the known Heathen usages of tutelary religion, but with that divine provision in the dedication of the temple by Solomon : "Concerning the stranger that cometh from a far country, when he shall pray toward this house ; hear thou in heaven, and do according as the stranger shall call upon thee."—1 Kings, viii. 42., &c.

support. In the tenth line, again, the Punic *moncot*, by first assuming the borrowed feather, and then dropping one of its own characters, first becomes *moncor*, and is then further transformed to *moccor*. Gesenius' words are, "*moncot* pro *moncor*, potest enim *moncor* esse part. Hoph. non contractum (*moccor*), מכר." Of the fourth line, the interpretation, "Virtute magna quæ diis est et imperio eorum" depends upon the mis-reading, *biru arob*, contrary to all authorities, for the authorized *birn arob* : the alleged authority for this reading being the simple *ipse dixit*, "Perbene ita jam Bochartus." The ninth line is very literally translated in the Plautine Latin so far as it goes, and Gesenius and Bochart in this instance, if they have not reached the mark, have not diverged more widely from it by emendation.

The interpretations which we owe to Gesenius, as originally and properly his own, remain to be acknowledged. That of the second line is as follows: *Ut ubi abstulerunt salutem meam, impleatur jussu eorum desiderium meum.* This interpretation is founded upon a conjectural emendation contrary to manuscript authority, substituting את תם, *incolumitas*, for *yth-mu* ; an emendation and interpretation which are discredited by the author's own misgivings, thus candidly expressed, "Hoc loco nec superiores interpretes mihi satisfecerunt, neque ipse mihi satisfacio." The sixth line Gesenius renders, *Vir contemnens loquentes fatua, strenuus robore, integer in agendo*, which he contrasts, rather complacently, with Bochart's still more extravagant interpretation, *Vir mihi familiaris sed is eorum cœtibus junctus est quorum habitatio est in caligine.* Seventh verse, *Filium est fama esse hic cognatum nostrum Agorastoclem* ; which Gesenius, in his notes, elucidates thus : Cognatum, "*ut Angli, a relation of mine.*" A rather bold *Prolepsis*, to say the least. For surely the next scene shows, that at the period of the monologue no surmise of such relationship had suggested itself to Hanno, but that, on the contrary, the *denouement* to that effect comes on him by surprise. Eighth line, *Eth emeneth*, nearly coincides with the reading I have adopted ; and I so far feel gratified, by having, for once, Gesenius on my side. But the ellipsis he has recourse to, to justify the interpretation, *token*, would not have appeared to him necessary, if he had recollected the reference above given, to the passage in Joshua, in which *eth emeneth*, or *oth emeneth*, appears to be an old Canaanitish phrase, of the same import as that used by Hanno, and used in the same sense by a person of the same stock and of the same religion.

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II. *An Essay on the Nature, Age, and Origin of the Sanscrit Writing and Language. By* CHARLES WILLIAM WALL, D.D., M.R.I.A., *Senior Fellow of Trinity College, Dublin.*

Read 13th November, 1837.

ALL the letters of the Hebrew text of the Bible, in its original state, were employed as signs of syllables, beginning with consonants and ending with vowels. The vowel part of every syllable was variable, and it was left to the judgment of the reader to determine that part for each place of the occurrence of a letter, according to what his knowledge of the language showed him the context required. Even still, near four-fifths of the vowels must, in reading the present unpointed text, be supplied in a similar manner; the only difference being, that they are no longer considered to be included in what the letters express, the powers of those letters having been decomposed, in consequence of which they are now used as consonants. The remaining portion of the text at present, indeed, exhibits signs for the vowel, as well as the consonantal, ingredients of the syllables, three of the letters being occasionally diverted from their original use to the purpose of vocal designation; but where those letters are now so employed, or rather where they were so in former times as far back as their pronunciation can be traced,* there they constitute no part of the original

* This distinction is necessary on account of the difference between the ancient and the modern pronunciation. Thus the word עִבְרִי, which signifies a Hebrew, is now read HiBRI (the mark under the H is used merely to point out that there is a difference in power between ע and the other Hebrew gutturals, although that difference is not now exactly known; and the Italic serves to show that there is no separate sign for it in the original group); but its Greek translation, Ἑβραῖος, proves that, at the time when the Septuagint version was made, it was pronounced HeBRaY, its sound terminating with that of the English monosyllable *ay*; and, consequently, that its final character belonged always to the text, although it is now read as a vowel letter when the writing is unpointed.

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writing in the sacred volume, and were introduced into it by the Jews after the Septuagint version had made them but very slightly acquainted with the value of such signs. Had they previously become more familiar with the subject, they would of course have adopted at least five vowel-letters instead of three, and they would have vocalized the whole of the text instead of only about one-fifth part of it. But however imperfectly and irregularly this vocalization was made,—and the very imperfection and irregularity which are observable in it, now contribute to the proof of its human origin;—still at the time of its insertion it was a most providential addition to the sacred text, to preserve the true meaning of the word of God; an object which in most, though by no means in all instances, it has certainly effected.

For the view of which an outline has now been laid before the Royal Irish Academy, I am indebted to a strong conviction long impressed upon my mind, that by that Providence which has so constantly and visibly protected the Bible, means must ever have been placed within human reach of reconciling the original text with its earliest and most important version; in consequence of which I was led into the frequent practice of selecting passages where they now disagree in sense, and trying how, with least alteration, the Hebrew might be written in such a manner as that the Greek should become its accurate translation.* Upon comparing what I had thus written out with the original, I found that, in a very great number of instances forming a large proportion of my trials, the difference produced in the Hebrew words was only in the letters *Waw* and *Yod*, when used as vowel signs;—a fact in itself sufficiently striking, but which could not be accounted for, in the way that first occurred to me, by the supposion of an exchange of those letters having taken place in the course of successive transcriptions; because, although they are at present very like, they were quite different from each other in point of shape in the more ancient Hebrew writing. What, then! suppose the letters in question,—where they now appear in the unpointed text as vowel-signs; or in the pointed text, as quiescents;—were not

* This mode of reconciling the Greek version with the original was first suggested to me by a few attempts so made, which I found in Bythner's *Lyra Prophetica*; and I was convinced of its being the right way of proceeding, by the consideration that the same groups of Hebrew letters, in the unpointed text, admit of different readings, and, consequently, of different senses. Bythner was prevented from making any effectual progress in this operation, by the circumstance of his taking the vowel points into account, as if they formed a constituent part of the original Hebrew writing.

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in the original record at the time when the Greek translation of it was made! Upon following up this thought I found, with the aid of certain consequences arising from it which the investigation suggested, that in far more than nine cases out of ten—perhaps I should come nearer to the true proportion in rating it at nineteen cases out of twenty—all difference between the Hebrew and its Greek version could at once be removed. And the unquestionable truth of the position on which I proceeded, was confirmed to me by inspection of the Samaritan text, in which it is, indeed, the same set of letters that are employed as vowel-signs, but the two I have already mentioned are much more frequently inserted, and the *Haleph*, though not very often, yet oftener than in the Hebrew; which proves beyond a doubt that all three were introduced into it at a later period, and when the use of such signs had become better understood among the Shemitic tribes. Thus the present Hebrew, the Samaritan, and the Greek memorials of the word of God, enable us to ascend to one common skeleton text; to the antecedent existence of which they all bear testimony; since, according to the different vocalizations of that original text, it admits of being read so as to agree with each of the three records. But I must add that, as the reading which is indicated by the Septuagint version is the oldest, so it is the best of the three; for, whenever the inspired writers of the New Testament quote from the Old, they sanction this reading, even where it differs from the Masoretic one*; and generally, in case of such difference, it is supported also by the Samaritan vocalization.

Causes of delay, over which I had no control, and interruptions which I did not anticipate when I published a preliminary volume with reference to this subject, have interfered with the progress of my labours in its more immediate development, and retarded the appearance of the second volume much longer than I could wish; but before another year elapses, I trust I shall be able to come forward with a corroboration of the views I have already submitted to the judgment of the public, together with such solutions of difficulties and answers to objections as have occurred to me, in explanation and support of the matter to

* Instead of the vocalization used in the unpointed text, the Masoretic one, which is grounded on it, is here mentioned, as restricting the original to the same sense in a more complete manner. The two systems, however, agree, as far as the ruder one extends, not entirely, but only for the most part.

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which I have just adverted. In the mean time I hope enough has been here stated to justify my availing myself of the disclosure, so far as to apply it to an object of a merely literary nature, though one of some interest; namely, the determination of the origin of the graphic system of the Brahmans.

Although alphabetic writing is, as I have elsewhere endeavoured to prove, of divine origin, yet the miracle employed to convey an apprehension of its nature and use to the human mind was not extended beyond what was necessary for the purpose. Accordingly in the first writing of this kind all the characters were originally used with syllabic powers; and as man was capable of rising by natural means from a syllabary to a superior alphabet, so he was left to his own exertions to accomplish this object. The great step necessary to his ascent depended on his discovering that the vowel parts of syllables admitted of but few varieties; on his disengaging those parts from the whole syllables; and on his classifying them and representing them by signs. Before the Greek transmuted the gutturals of the old Phœnician alphabet (most of which were of no service to him in their original use) into vowel-letters, he must have gone through some process of this kind in his thoughts; and to his genius and sagacity is due the beautiful invention which has given such an immense superiority to the alphabetic writing of Europe over that of Asia. As long as Hebrew continued a living language the syllabic signs answered every requisite purpose; but when it went quite out of familiar use, the ruder method of designation was no longer sufficient for preserving the sacred text. Before this was actually the case, and as soon as ever the necessity for an alteration arose, we find matters so arranged that the Bible was translated into Greek, and that a very important improvement was introduced into Hebrew writing itself. The national prejudices of the Jews, and their backwardness in literary acquirements, would lead one to suppose they would be the very last people to avail themselves of the improvement in question, yet they appear to have been the first. They certainly took this improvement immediately from the Greek writing, and it is common to them with all the Shemitic nations of Asia;* but so very peculiar a mode of vocalization,—whereby

* It is, I believe, chiefly owing to the circumstance of all those nations having adopted the same method of vocalization, that it has been assumed to be an essential part of the writing employed by each of them, and that its adventitious nature has been so long concealed. But if once attention be turned to the various proportions in which the letters applied to the use of this method are inserted

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an *h* is occasionally made to stand for *a* or *e*; a *y* for *e* or *i*; and a *w* for *o* or *u*;—is not by any means likely to have been adopted by different people independently of each other. In accordance with the supposition of this vocalization having commenced with the Jews, is the fact, that it is more imperfect in the Hebrew writing than in any other Shemitic system in which it is used; it is fuller,—and of course was later inserted,—in the Samaritan, and is still fuller in the Chaldee, the Syriac, the Arabic, and the Persian systems.* On the other hand, the methods of pointing the Hebrew, the Syriac, and the Arabic, which were separately invented to supply the defects of the older mode of expressing vowels that is common to them all, vary considerably from each other; and the very curious vocalization of the Ethiopic or Abyssinian system, which, as well as that first annexed to the Hebrew, was derived immediately from the Greek, is of a nature wholly different from any that has been yet alluded to. The period when the Ethiopic writing received this improvement shall be presently investigated.

It is to the system last mentioned that I propose tracing the origin of the writing which is connected with the Sanscrit language. But as some very gross errors with respect to the nature of alphabets in general, and of the Abyssinian syllabary in particular, have of late been confidently and plausibly advanced; their refutation becomes necessary as a preliminary step to my progress. The erroneous views to which I allude will be found collected together in the following passage of a paper of M. Abel-Remusat, late Professor of Chinese in the Royal College at Paris, which was read to the *Institut de France* in the year 1820. "Par syllabaire j'entends ici une réunion de signes syllabiques indépendans entre eux, sans analogie les uns avec les autres, et par conséquent indécomposables ou indivisibles. Cette propriété constitue le second degré dans les trois sortes d'écritures que les grammariens distinguent, le système mixte entre l'écriture alphabetique et l'écriture figurative. On ne saurait en rapprocher la prétendue écriture syllabique éthiopienne, moins encore celles des Hindous ou des Tartares.

in the several systems; and still more, if the total difference of the vocalization annexed to the Ethiopic system be considered in connexion with this subject; the circumstance in question must cease to mislead the judgment.

* The modern Persian *language* is such a medley of different tongues that it is difficult to determine to what class it should be referred; but as to the modern Persian *writing*, there can be no doubt of its being Shemitic, as the alphabet employed in it differs from the Arabic one, only by the addition of a few letters.

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Ce sont là de véritables alphabets, dont on forme à volonté un syllabaire, comme nous le faisons nous-mêmes avec les lettres de notre alphabet."—*Memoires de l'Institut*, tom. viii, p. 55. This passage was written in reference to the Japanese syllabary, which the author contended to be the only one as yet discovered in actual use (in order that he might make out the Corean system to be not a syllabary, but a complete alphabet of consonants and vowels); although in his volume of *Recherches sur les langues Tartares*, published in the very same year, 1820, he endeavoured to prove that the Tartars formerly employed syllabaries of their own invention. Passing by, however, this inconsistency, I have to observe, that in the extract before us, short as it is, there are yet included four very material errors.

In the first place, the Professor, in expressing his conception of a syllabary, has omitted its essential property,—namely, its being limited to some fixed number of terms;—instead of which he has substituted an accidental one, and made its nature in part depend on that of the characters by which the syllabic powers of the system are represented. The nature of the characters undoubtedly may give rise to the subordinate distinctions of different species; but that it is not essential to the general idea of a syllabary, is evident from a consideration of the very one which gave occasion to his remarks. The Japanese syllabary can be written in seven or eight different ways, namely, with the *kata-kana* characters, or the *fira-kana*, or the *yamato-kana* characters, &c. Yet still, the series of powers thereby denoted remaining in every respect unchanged, the system continues to be essentially one and the same; and is called either the Japanese syllabary from the people who make use of it, or the *I-ro-fa* syllabary, from the first three powers of the series. If any one choose to speak of the *kata-kana* syllabary, or the *fira-kana*, or the *yamato-kana* syllabary, I do not object to this mode of expression; as it is only making the distinction of subordinate species which must still come under the common denomination of the *I-ro-fa*, or the Japanese syllabary. M. Klaproth, I observe, in a formal treatise upon this syllabary, published in the volume of the *Nouveau Journal Asiatique* which came out in the year 1829, expresses himself indifferently in either way. The title of his paper is as follows: "Sur l'Introduction de l'Usage des Caractères Chinois en Japon, et sur l'Origine des différens Syllabaires Japonais." Here he speaks of different syllabaries; but, when introducing the subject, he more

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correctly, as I conceive, talks of one syllabary written with different sets of signs. "On sait que les Japonais se servent à présent de deux genres d'écriture, c'est-à-dire, qu'ils emploient, ou les caractères ideographiques des Chinois, ou *un syllabaire* composé de quarante-sept syllabes, qui sont représentées par diverses series de signes."—tom. iii, p. 27.

It is not, however, necessary to appeal to any authority on the point in question; common sense shows that every phonetic system must, in its general nature, depend essentially on the powers which it represents, and on them alone. Thus, for instance, our alphabet is called the English alphabet, whether it be exhibited in Roman or Italic characters, in capitals or in small letters, in those appropriate to print, or in such as are employed in manuscript; but if the powers be changed to those of French pronunciation, though the collection of characters remains precisely the same—for of late the French have introduced *w* into their writing for the expression of foreign sounds—yet the system is changed, and can no longer be termed the English alphabet. What led M. Abel-Remusat to attach to the shape of letters an importance that does not really belong to it, was probably the circumstance, that, if the characters be indivisible into parts corresponding to the elements of the syllables they represent, those syllables are less likely to be decomposed. There is, however, no necessary connexion between the one decomposition and the other. The characters might be indivisible in the manner just mentioned, and yet the syllables be separated into their component parts (of which the Hebrew letters afford a very striking instance); and on the other hand they might be divisible in a way which would obviously give assistance to the decomposition of the syllables, and yet (as shall presently be shown) that decomposition not take place. But let the conformation of the characters aid the reader ever so much in this analysis, and tend ever so much to suggest the operation to his thoughts, still as long as he failed to decompose the syllables, the system would yet remain, in reference to his apprehension, no more than a syllabary.

In the second place, M. Abel-Remusat was quite unwarranted in representing syllabic writing as distinct from alphabetic, in a degree at all parallel or analogous to that in which it is separated from hieroglyphic designations. It is true that a syllabary is intermediate, in the order of learning, between less imperfect alphabets on the one hand, and hieroglyphs on the other (for we never could rise to a

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conception of consonantal powers except through such a medium,—a point which has been fully explained in my publication on the origin of alphabetic writing); but it is by no means intermediate between them in its nature; on the contrary, it is of the same general nature as an alphabet, in those respects in which the latter can be brought into comparison with an ideagraphic system. They both belong to phonetic writing, and still more, to a common species of such writing; inasmuch as both are distinguished by the essential property of being confined to some determinate number of signs. However inferior, then, a syllabary may be to a system of consonants and vowels, it is, notwithstanding, entitled to the same general denomination. Hence I have, throughout the part of my work which has been already published, called such systems syllabic alphabets; and in doing so I was justified not only by the real state of the case, but also by precedents of high authority. Thus, although in the portions of the Ethiopic version of the Bible which have been printed, the powers of the letters are undoubtedly syllabic, and are described as such by all the earlier writers on the subject; yet the collection of those letters was commonly denominated by them an alphabet, and may be seen in the Prolegomena of Bishop Walton's Bible, as also in the short grammatic treatise prefixed to Dr. Castell's Heptaglot Lexicon, printed with the title of ALPHABETUM ÆTHIOPICUM placed over it. The Chinese Professor, however, attached more weight to the opinions of certain modern grammarians, whom he has not mentioned by name; and with them he decided that a syllabary is not an alphabet, but "a mixed system between alphabetic and hieroglyphic writing." I should not object to this new use of old established words, if it had not a tendency to perplex the mind, and to give a very erroneous view of the subject under consideration.

In the third place, the most extraordinary of the mistatements of M. Abel-Remusat in the passage before us, is the assertion that the Ethiopic system of phonetic signs is not a syllabary. If indeed he had insisted that this system was not composed of "alphabetic and hieroglyphic writing mixed together," the position would be at once admitted. But this truism could not be his meaning, as the putting it forward would be merely fighting with a shadow; for no one ever contended that the Ethiopic characters were partly hieroglyphs. After all then, to render him intelligible and read in his words something more than mere unmeaning sounds, he must be considered as deserting his own definition

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immediately after having given it, and as using the term syllabary here in its ordinary acceptation. Accordingly, by his denial of the Ethiopic alphabet being a syllabary, he must be understood to maintain, that the powers of the letters employed in this writing are not syllabic. I confess I was startled by this part of the passage under examination when I first read it, and should not have been more surprised by a bold denial of the Greek and Roman alphabets being systems of consonants and vowels. Had the latter declaration been made with ever so much confidence, of course I should not have thought it necessary to refute it; but as the Ethiopic writing is not so generally known, a short account of it here may perhaps not be superfluous.

When by the discovery made by the Portuguese navigators of a passage round the Cape of Good Hope, a direct communication was opened with Abyssinia, and intercourse with the inhabitants became in consequence more frequent, the attention of the learned was turned to the very peculiar kind of writing employed by that people; and great interest was excited by the appearance of a version of the Scriptures in a language and character then first brought into notice in Western Europe. The study of this version was much facilitated by the nature of the language, which was found to have a very close affinity to Hebrew;* it was encouraged even by the Popes, from a desire to provide means for the extension of their spiritual dominion over a distant empire; and it was considerably promoted by their having granted an asylum and permanent resi-

* The curious fact of an African people speaking a dialect of Hebrew is, perhaps, best accounted for by Nicephorus (Callistus) in his Ecclesiastical History; where, incidentally describing the extensive district of Abyssinia between Axum and the ocean near its junction with the Red Sea, he informs us, that the inhabitants called themselves Assyrians; that up to his time they spoke the Assyrian (or Chaldee) language; and that they were the descendants of colonists who had been transported thither from Syria by Alexander the Great. Certainly it must have been some very despotic measure by which their forefathers were driven to so ungenial a clime; and no one was more likely than the Macedonian conqueror to have put this into execution, both from the extent of his power and the violence of his disposition. The passage to which I refer, is as follows:— *Ταύτης τοίνυν τῆς ἐρυθρᾶς τοῖς ἔξωθεν μέρεσιν ἐν ἀριστερᾷ Ἀυξουμῖται εἰσὶν, ὧν ἡ μητρόπολις Ἄυξουμις. Περὶ δ' αὐτῶν εἰσὶν ἐπὶ τὸν ἐξωτάτω καθήκοντες Ὠκιανὸν πρὸς ἀνατολὰς, Ἀσσύριοι· ταύτῃ δὲ τῇ κλήσει, καὶ παρ' αὐτοῖς ὄνομα φέρουσιν· οὓς Ἀλέξανδρος ὁ Μακεδὼν, ἐκ Συρίας ἀναστήσας, ἐκεῖ κατῴκισεν· οἱ δὲ ἐς δεῦρο τῇ πατρίᾳ γλώσσῃ χρῶνται.*— *Historiæ Ecclesiast.* lib. ix, c. 18.

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dence in Rome to Abyssinian exiles, of whom great numbers were, about that time, forced to leave their own country by Mohammedan persecution. Through the advantage of such aids, a knowledge of this writing was soon obtained, and parts of the Ethiopic translation of the Bible were printed in the Roman capital under the superintendence of native Abyssinians; the Psalms and Song of Solomon, during the remarkable pontificate of Leo the Tenth,* and the New Testament not many years after. Then followed from the press, in different countries of Europe, grammars, lexicons, harmonies, in all of which, and also along with the portions of Scripture first published, were given the Ethiopic alphabet represented as a syllabary. From the parts of this version which were printed, it was ascertained to be one of great antiquity, as it agrees with the oldest known Greek copies of the Bible in many passages which are otherwise written in less ancient MSS. Hence much attention was paid to the work, and several of the most able scholars and divines of the sixteenth and seventeenth centuries engaged in its examination; but however they may have differed among themselves upon other points, not one of them, as far as I can find, ever dissented from the above representation of the nature of the Ethiopic letters. To oppose such authority it is plain that a very strong case should be made out; but the Professor has offered nothing against it more than his own opinion, which he did not support by any proof, nor indeed could he; for the slightest examination of the alphabet itself will be sufficient to show that his view of the matter was totally erroneous.

* It is but justice to Leo to state, that the part of this version which came out under his auspices was much more accurately executed than the remainder of the original publication. This will, I conceive, be clearly seen upon a comparison of the reprints of the two parts in Bishop Walton's Polyglot Bible, in which the Psalms are given much freer from errors of the press than the New Testament.

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Ethiopic Alphabet.

Hoi	ሀ hă	ሁ hu	ሂ hi	ሃ hā	ሄ hē	ህ hĕ	ሆ ho	ה	He.
Law	ለ lă	ሉ lu	ሊ li	ላ lā	ሌ lē	ል lĕ	ሎ lo	ל	Lamed.
Haut	ሐ hă	ሑ hu	ሒ hi	ሓ hā	ሔ hē	ሕ hĕ	ሖ ho	ח	Heth.
Mai	መ mă	ሙ mu	ሚ mi	ማ mā	ሜ mē	ም mĕ	ሞ mo	מ	Mem.
Saut	ሠ să	ሡ su	ሢ si	ሣ sā	ሤ sē	ሥ sĕ	ሦ so	ס	Samekh.
Rees	ረ ră	ሩ ru	ሪ ri	ራ rā	ሬ rē	ር rĕ	ሮ ro	ר	Resh.
Saat	ሰ să	ሱ su	ሲ si	ሳ sā	ሴ sē	ስ sĕ	ሶ so	ש	Shin.
Qaf	ቀ qă	ቁ qu	ቂ qi	ቃ qā	ቄ qē	ቅ qĕ	ቆ qo	ק	Qoph.
Bet	በ bă	ቡ bu	ቢ bi	ባ bā	ቤ bē	ብ bĕ	ቦ bo	ב	Beth.
Taw	ተ tă	ቱ tu	ቲ ti	ታ tā	ቴ tē	ት tĕ	ቶ to	ת	Taw.
Harm	ኀ hă	ኁ hu	ኂ hi	ኃ hā	ኄ hē	ኅ hĕ	ኆ ho	ח	Heth.
Nahas	ነ nă	ኑ nu	ኒ ni	ና nā	ኔ nē	ን nĕ	ኖ no	נ	Nun.
Halph	አ ă	ኡ u	ኢ i	ኣ ā	ኤ ē	እ ĕ	ኦ o	א	Haleph.
Kaf	ከ kă	ኩ ku	ኪ ki	ካ kā	ኬ kē	ክ kĕ	ኮ ko	כ	Kaph.
Waw	ወ wă	ዉ wu	ዊ wi	ዋ wā	ዌ wē	ው wĕ	ዎ wo	ו	Waw.
Hayin	ዐ ă	ዑ u	ዒ i	ዓ ā	ዔ ē	ዕ ĕ	ዖ o	ע	Hayin.

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Zai	ዘ *zä*	ዙ *zu*	ዚ *zi*	ዛ *zā*	ዜ *zē*	ዝ *zĕ*	ዞ *zo*	ז	Zayin.
Yaman	የ *yä*	ዩ *yu*	ዪ *yi*	ያ *yā*	ዬ *yē*	ይ *yĕ*	ዮ *yo*	י	Yod.
Dent	ደ *dä*	ዱ *du*	ዲ *di*	ዳ *dā*	ዴ *dē*	ድ *dĕ*	ዶ *do*	ד	Daleth.
Geml	ገ *gä*	ጉ *gu*	ጊ *gi*	ጋ *gā*	ጌ *gē*	ግ *gĕ*	ጎ *go*	ג	Gimel.
Tait	ጠ *tä*	ጡ *tu*	ጢ *ti*	ጣ *tā*	ጤ *tē*	ጥ *tĕ*	ጦ *to*	ט	Teth.
Pait	ጰ *pä*	ጱ *pu*	ጲ *pi*	ጳ *pā*	ጴ *pē*	ጵ *pĕ*	ጶ *po*	פ	Pe.
Tzadai	ጸ *tzä*	ጹ *tzu*	ጺ *tzi*	ጻ *tzā*	ጼ *tzē*	ጽ *tzĕ*	ጾ *tzo*	צ	Tzade.
Zzap	ፀ *zzä*	ፁ *zzu*	ፂ *zzi*	ፃ *zzā*	ፄ *zzē*	ፅ *zzĕ*	ፆ *zzo*	צ	Tzade.
Af	ፈ *fä*	ፉ *fu*	ፊ *fi*	ፋ *fā*	ፌ *fē*	ፍ *fĕ*	ፎ *fo*	פ	Phe.
Psa	ፐ *pä*	ፑ *pu*	ፒ *pi*	ፓ *pā*	ፔ *pē*	ፕ *pĕ*	ፖ *po*	פ	Pe.

After each series, above exhibited, of syllabic signs formed by variations of a common letter and called by a common name, is subjoined in the same line the corresponding Hebrew letter with its name, to show the connexion which in many instances obviously holds between those words. The period when this alphabet was derived from the Hebrew or some other Shemitic syllabary is lost in impenetrable obscurity; but whenever it was that the primary formation of the system took place, it must at that time have consisted solely of its first column of characters; the remaining columns could not have been added till after the Abyssinian had, in his conception of the subject, arrived at a distinct classification of the vocal elements of his syllables. The different pointings that are placed under the consonantal parts of the guttural powers, are intended merely to intimate that those powers differ from each other, though what is peculiar to each is now no longer known.

I have not marked the quantity of the powers in all the columns of the above table; as there is some difference in this respect between Bishop Walton's

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and Dr. Castell's representations, chiefly in consequence of the latter author having taken into account the effect produced by the position of syllables in words, the first and penultimate syllables being generally read long, and the remaining ones short. There is a difference also between them as to the vocal part of the powers in the sixth column, which is represented by Dr. Castell as a *y*. But as this part, except when in the first or penultimate syllable of a word, is pronounced rapidly, and in consequence indistinctly, it is very immaterial whether it be denoted by a short *e* or short *y*. These differences may possibly have been in some measure occasioned by want of uniformity in the practice of a people, who could not be expected to have very exact notions on the subject, as it appears they were unable to disengage consonants from syllables. But from whatever causes they may have arisen, they have no relation to the inquiry before us; they may perhaps affect the certainty as to the length of the powers, and as to the sound of the vocal part of those in the sixth column; but they do not in the remotest degree bear against their general nature as syllabic. The only powers about which there can be any question under this head, are those belonging to *Halph* and *Hayin*, which are usually represented by series of vowels; but it is evident that both sets of powers could not at first have been merely vocal, as in that case they would have been exactly the same, and one of the letters, as superfluous, would never have been introduced into the alphabet; nor is it at all likely that either set were formerly such, since to a certainty neither of the Hebrew characters which are called by the same names was originally a vowel-letter. But if any doubt on the subject should remain upon the reader's mind, it will, I trust, be entirely removed by inspection of some specimens of this writing which shall be immediately laid before him, one of them having a strong bearing on this very point. Admitting, however, that in later times when this system was printed, both letters were used to denote vowels, still even thenceforward by far the greater number of the powers remain syllabic. In order to make use of the foregoing table it is necessary to observe, that, when a character drops the vocal part of its own power to share that of a preceding character in the formation of a compound syllable, it is the variety of shape that occurs in the sixth column which is employed; and also that the letters are read from left to right, in the same direction as in European legends, the Ethiopic writing differing in this respect from the graphic systems of all the other Shemitic languages.

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Now if it be allowed that proper names are pronounced nearly in the same way in cognate languages, it will be very easy to verify the powers above assigned to the Ethiopic letters, so far at all events as to show that they are syllabic; viz. by exhibiting any such words from the text of the Ethiopic version. For this purpose the names *David* and *Abimelech* are here selected from the title of Psalm xxxiv., as also *Zion* and *Jerusalem* from Psalm li. 19*; just as they are written in the version in question and in the unpointed Hebrew text, except that the prefixes are in both kinds of writing omitted. After each group of characters the pronunciation is given in Roman consonants and Italic vowels; but when there is a separate character added to express the vocal part of a syllable, as is sometimes the case in the copies of the Hebrew Bible which are at present extant, then its power is denoted by a Roman vowel, and it is itself exhibited in an open form, to distinguish it from the ancient letters of the group, and mark its adventitious nature.

1.	ደዊት	(D*a*W*i*T)	2.	አቢሜሌክ	(H*a*B*i*M*e*L*e*K)
	דוד	(D*a*W*i*D)		אבימלך	(H*a*BIM*e*L*e*K)
3.	ጽዮን	(TZ*e*Y*o*N)	4.	ኢየሩሳሌም	(H*i*Y*a*R*u*S*a*L*e*M)
	ציון	(TZ*i*YON)		ירושלם	(Y*e*RUSH*a*L*e*M)

To apply to the point under examination any of these examples, as for instance, the first of them;—if we look for the character ደ in the Ethiopic alphabet, we shall find it in the series of letters which are in common termed *Dent*, and in the first column, where the power assigned is D*a*; in like manner we shall find ዊ in the series *Waw*, and third column, with the power W*i*, and ት in the series *Taw*, sixth column, with the power T*e*. But the vocal part of the powers in the sixth column is very short, except when those powers form the first or penultimate syllable of a word; and when they form the last, it becomes imperceptible like the Shewa quiescent of the pointed Hebrew. According, then, to the representation of the powers of the characters which is given in the table, the group ደ ዊ ት expresses the word D*a*W*i*T; while, on the other hand, from the position of the same group in the title of Psalm xxxiv. in the Ethiopic version,

* The number of each Psalm after the tenth is diminished by one (in consequence of the eleventh being joined to the tenth) in the Ethiopic version, which herein agrees with the Septuagint, and differs from the Hebrew.

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we may be certain that it denotes the Royal Psalmist, and, consequently, that it must have been read by some combination of sounds nearly approaching to D*a*W*i*D, the ancient pronunciation of his name in Hebrew and, after the Hebrew, in the Septuagint. This group, therefore, fully verifies the powers assigned to the first and second of its elements, and that of the third by approximation. The second group, examined in like manner, will serve to establish the correctness of the powers attributed to every one of its ingredient characters without exception. In the third group, although it may be proved in the same way that the powers of the characters are syllabic, yet it is questionable whether the vocal part of the first power be *e* or *y;* and as it is here long, (from the position of the syllable in the word expressed), the difference is perceptible; while the example seems to accord better with Dr. Castell's than the Bishop's representation of the powers of the sixth column, unless it be allowed that *e*, followed by the consonant *y*, has a sound approaching to that of *i*. The first three names are pronounced very nearly the same in the Septuagint as in the Hebrew, and, consequently the groups we have been examining do not enable us to determine from which text the Ethiopic version was made; but the fourth group clearly marks the derivation of this version immediately from the Septuagint. The Greek translator was unable exactly to express the first syllable of *Yerushalem*, and substituted for it *Hie*. The Ethiopic writer has also given two syllables in place of the original one, but not from any inability to express that one; and therefore he must evidently have done so from his having translated from the Greek. It deserves moreover to be here noticed, that in his imitation of *Hie*, he has expressed *e* by the syllable *ya;* which clearly points out that the series of letters termed *Halph* and *Hayin* did not denote mere vowels at the time when he made his translation; for if they had, it surely is by one of the characters of either series that he would have represented the second part of *Hie*. It may be also remarked, that the first name is represented exactly by the same number of letters in the Hebrew as in the Ethiopic writing; and as those in the derivative writing have undoubtedly syllabic powers, there is even hence some probability of the corresponding elements of the group belonging to the parent system having been at first employed with like powers. If the letters in the Ethiopic designation of this name were divested of the marks which serve to confine the terminations of the syllables they denote to particular sounds, the whole group would then be pre-

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cisely analogous in its use to the Hebrew one; in which the vowel parts of the syllables expressed are left to be determined by the reader through the means of his familiarity with the spoken denomination of the Jewish sovereign in question. The first letter, indeed, of the Ethiopic group is destitute of any mark, as it belongs to the first column of the alphabet, which is now limited to syllables ending in *a*; but before the addition of the other columns this one evidently could have had no such limitation; and then the Ethiopic method of denotation was exactly of the same nature with the original Hebrew one, not only in reference to the name which I have here happened to pitch upon as an example, but also with regard to every part of the two kinds of writing.

To show the close affinity which subsists between the two languages, I here subjoin the first sentence of the Lord's Prayer, Matthew, vi. 9, from the Ethiopic version; with the equivalent Hebrew expression immediately under each group, just as in the preceding examples.

ኦቡነ (H*a*B*u*N*a*)	ዘበሰማያት (Z*a*B*a*SS*a*M*a*Y*a*T)
אבינו (H*a*BINU)	שבשמים (SH*e*BB*a*SHSH*a*M*a*Y*i*M)
Our Father	who—in the very heavens,
ይትቀደስ (Y*e*TQ*a*DD*a*S)	ስምከ (S*e*MK*a*)
יתקדש (Y*i*THQ*a*DD*e*SH)	שמך (SH*e*M*e*K*a*)
hallow itself (*i. e.* hallowed be)	thy name.

The corresponding groups in the two ways of writing the sentence will be found to agree in their roots; in their inflexions (excepting the formation of the plural number of the noun); in the reflective form of the verb, and the peculiarity of substituting that form for the passive one; in their prepositions; in their pronouns;* and in the manner in which those pronouns enter into combination with the principal terms; whence it is probable that they may, in some degree at least, agree also in the collective sounds denoted by them. If this inference be ad-

* I admit that the syllable prefixed to the Ethiopic expression for *in the very heavens*, and used with the signification of the pronoun *who*, is not derived from the relative אשר but from the demonstrative זה. This latter pronoun, however, is sometimes used in the Hebrew, as it is here in the Ethiopic, with a relative sense.

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mitted, it affords, in its application to the passage before us, another verification of the powers of the Ethiopic letters; not indeed as exact a one as that derived from comparing proper names, but still sufficient to show to a certainty that the general nature of those powers is syllabic, which is all that is necessary to be proved upon the present occasion.

The ground of M. Abel-Remusat's mistake on this subject,—a mistake indeed which pervades the whole of his treatise on the origin of the Tartar alphabets,—is his having overlooked the difficulty which illiterate people experience of conceiving a consonantal power. It is true that the Abyssinian had a clear conception of vowels,—this is obvious from the bare inspection of the table of his alphabet;—and he must have had an equally clear one of consonants, if he had arrived at those vowels by any analysis made by himself of the syllabic sounds of his language. But what would be the inevitable consequence? Having by this process discovered the powers of a superior alphabet, he could not be ignorant of the nature of his own discovery; he must have been aware of its value, and thence unquestionably would have availed himself of its use. It is quite contrary to all that is known of human nature to suppose that any people would encumber their memories with a system of 182 characters (besides twenty more which do not regularly form part of the alphabet), if they had themselves found out a way by which they could write equally well, or indeed better, by means of only thirty-three signs; namely, twenty-six for consonants, and seven for vowels. Nations, I admit, often reject the inventions that have originated in other countries, through prejudice against what is foreign, or through ignorance of the resulting benefits. But neither impediment here lies in the way; and no well ascertained instance can be produced from the history of the world, of men arriving by their own efforts of thought at an important improvement in any art, and yet foregoing its advantage.

The fault of the Professor's reasoning on this point appears to have been, that he began at the wrong end. Having himself a clear conception of a consonantal as well as a vowel power, he took it for granted, that the Abyssinian had equally clear notions on the subject, and was able to conceive an articulation separate from any vowel sound by which it might be rendered perceptible to the ear. Well, then! the poor African having quite distinct in his thoughts the elements of syllables, would take care to have their signs equally distinct; and the very

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nature of the characters of his system would at once point out the mode of effecting their decomposition to one who was already acquainted with the decomposition of their powers. Nothing, then, could be more easy to him than the rising from his syllabary to a superior alphabet; and it is absurd to suppose that he would not avail himself of the advantage of this alphabet which was so completely within his reach. Hence, in spite of all former evidence, and in spite of present appearances, it would, from such reasoning, necessarily follow, that the Abyssinian really used the elements of his graphic system as consonants and vowels. To this extraordinary conclusion at all events M. Abel-Remusat actually came, whether the train of thoughts which led him to it was exactly that which I have described, or one in any respect different. Now, as I apprehend, the safest mode of proceeding is to commence with what may be known to a certainty, not merely through the concurrent evidence of great numbers of men eminent for learning and ability, but also by our own observation. The letters belonging to the text of the Ethiopic Bible are, to a certainty, and beyond all question, therein employed with syllabic powers. The Abyssinian, therefore, did not know how to make out of his system a superior alphabet; and, consequently he could not have had any clear conception of a consonant.

From the fact which has been just established, it follows that the Abyssinian did not, by means of his own penetration and sagacity, acquire the conception of vowels which enabled him to make the classification, exhibited in the table of his system, of the syllabic powers that he referred to each letter. For he could not, by any analysis of the articulate sounds expressed by those letters, have arrived at vowels without reaching, by the same process, to consonantal powers. The addition, therefore, to his alphabet of all the columns after the first,—by means of which his syllables are, in reference to their vocal ingredients, methodically arranged and definitely expressed,—must have been derived by him from some external source. But he could not have taken the hint which guided him in this matter from observation of any of the other Shemitic systems; as the several modes of pointing them did not commence till long after; and if he had first met with the older vocalization that is common in kind, though not in quantity, to all those systems, he would, it is plain from analogy, have adopted it, in like manner as all others placed in the same circumstances had done, however he might have subsequently differed from them in his mode of supplying the defects of that

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primary vocalization. There was, consequently, no other quarter from which he could have learned the use of vowel designation except from Greek writing; and he, as well as the Jew, must have had his notions on the subject suggested to him immediately from that writing. Accordingly, his translation of the Bible affords very decisive evidence that, when he made it, he had only the Septuagint version, and not the Hebrew Scriptures, in his possession; and, in further corroboration of this view of the case, it may be observed, that the vocal part of the syllabic powers of his alphabet has an obvious affinity to the vowels of the Greek system. For although all vowel sounds equally admit of an open and close state, yet in both those systems the distinction is made in the denotation of only two of them; while one of the vowels so distinguished (*e*) is the same in each system, and the total number of vowels in each is also the same. On the other hand, the Ethiopic syllabary in its primitive state, it is plain, was derived either immediately or remotely from the ancient Hebrew one. Before the vocalization of either system had taken place their corresponding elements must evidently have been used in the same manner with powers that were precisely similar; and even still above half of those elements are called by names that are very nearly the same. The difference in the shapes of the characters is no objection to this connexion between the two alphabets; some few of the corresponding ones are like each other, when the more ancient forms of the Hebrew letters are referred to; and if still older elements of each series were extant, their similarity would probably be yet more striking. Besides in tracing a connexion of the kind, we must look for the proof of it far more in the powers than in the shapes of the characters which are compared. Thus our numeric figures, though different in form from the Indian ones, are on all sides admitted to be thence derived, because they are employed in the same way, and their values are regulated by the same principle. And still further it may upon this point be observed, that there are several alphabets, confessedly derived from the Sanscrit one, from which, notwithstanding, they wholly differ in the shapes of their letters. Again the difference in the order of the letters of same name does not bear against the Hebrew origin of the Ethiopic system; for there is as great a difference at present in point of arrangement between the Hebrew and Arabic letters which correspond with each other, and yet from their being used with the same numeric powers, it is plain that their order must likewise have originally been the same.

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A very close limit to the age of the Ethiopic scriptures may be deduced from evidence which history supplies connected with the subject. The Christian religion was first established in Abyssinia by Frumentius, who was for this purpose consecrated Bishop of Axum in the year 335 by the celebrated Athanasius, Patriarch of Alexandria. The circumstances which led to the conversion of the Abyssinians are told by Rufinus in the ninth chapter of the first book of his Ecclesiastical History, who closes his account by stating that he had it immediately from a companion of Frumentius;—"Quæ nos ita gesta, non opinione vulgi, sed ex ipso Edesio, Tyri presbytero postmodum facto, qui Frumentii comes prius fuerat, referente cognovimus." The Abyssinians themselves claim a much earlier date for their conversion to Christianity, and assert that they were previously followers of the Jewish creed. But their account of the matter is so obviously fabulous as not to be entitled to any notice; and the part of it last mentioned is refuted even by their own version of the Bible; for surely if they had been Jews by religion, they would have had the Old Testament in the original Hebrew,—in a tongue cognate to their own, and from which consequently they could have much more easily translated the Scriptures than from Greek. It is further recorded in history, that the Abyssinians were again converted to Christianity in the reign of the Emperor Justinian, that is, about two hundred years after the first time; from which it would appear that they had in the interval relapsed into paganism. But it is not necessary to consider the authorities on which the narrative of this second conversion rests; as the first is the only one to which it is material here to attend.*

But to return to the passage upon which I have been commenting;—I shall conclude my remarks on it by pointing out, in the fourth place, M. Abel-Remusat's error in supposing that the Abyssinians formed the syllabic powers of

* Scaliger, in his learned work *De Emendatione Temporum*, notices the second conversion of the Abyssinians; but very unaccountably overlooks the first, which is fully as well authenticated. His words upon the subject are as follows:—"Jactant vetustatem Christianismi a Candace Regina et Philippo Apostolo. Sed id manifesto falsum convincit Ecclesiastica Historia. Anno enim XV. Justiniani Imperatoris, Adad Rex Axumitarum vovit, si vinceret Omeritarum vicinorum Regem, se Christianum factum iri. Victo rege Omeritarum, missis ad Justinianum legatis, impetravit ab eo episcopos, qui primi omnium tunc Christianismum in Æthiopia publicarunt."—*De Emend. Temp.* lib. vii, p. 682.

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their system in the same way as Europeans combine syllables out of more simple ingredients. At the bottom of this hypothesis lies the very identical fallacy which has been exposed in the preceding instance, namely, the assumption that the Africans in question had a distinct conception of both the ingredients of syllabic sounds; whereas it has been proved that they had only one of those ingredients clear in their thoughts. The hypothesis may still further be shown to be erroneous from the manner in which the Abyssinians recited their alphabet. I do not here speak of their present practice (with which, I confess, I am not acquainted), but of that which prevailed among them at the time when parts of the Ethiopic version were printed under the superintendence of individuals belonging to their nation. The seven columns of their alphabetic table they called by names which had no relation whatever to the vowel sounds in those columns, viz.—1. Gheez.—2. Chaab.—3. Sals.—4. Erab.—5. Hams.—6. Sads.—7. Sab. And their mode of recitation was as follows. Let us, for instance, take the series of syllabic powers classed under the letter *Bet*. They first called out *Bet Gheez*, and then pronounced the syllable B*a*; next, *Bet Chaab*, after which they pronounced B*u*; next, *Bet Sals*, after which, B*i*; and so on. As much as to say, that *Bet*, as written in the column *Gheez*, sounds B*a*; as written in the column *Chaab*, sounds B*u*; and so on. Here evidently is no indication of the Ethiopian having had any perception of the compound nature of the powers recited by him. The fact is, he no more looked on such powers as complex than the Japanese now does, who, although he has vowels, as well as what are more properly called syllables, denoted by letters of his system, yet considers the latter species of sounds to be as perfectly simple and undecomposable as the former. On the contrary, the European is taught signs for the separate ingredients of articulate sounds before he is made to bring them together for the expression of those sounds; which circumstance of itself must draw his attention to the fact of there being some composition in syllabic powers; and when, through this observation, and the practice of repeating *b a, ba; b e, be; b i, bi*, &c., he has arrived at the distinct perception of what is denoted by consonants, he dismisses from his thoughts the cumbrous machinery by which he acquired this knowledge. He must indeed commit to memory the combinations of letters representing words which are peculiarly spelled; but he retains as the elements of his orthography, not the hundred, or more, simple syllables, *ba, be, bi*, &c. &c., but merely the

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four or five and twenty consonants and vowels of which those syllables are composed. While, on the other hand, the Abyssinian was forced to recollect all through, the two hundred and two signs of his system, together with their powers.

The errors which have in the foregoing pages been exposed respecting the essential nature of alphabetic writing, it may be here by the way noticed, were committed in a capital which affords, by its libraries and learned societies, the greatest assistance to studious investigation; and are those, not merely of a man of some talent and research, but also of one who devoted particular attention to a branch of the very subject in question. Now when, under such circumstances, an author has betrayed ignorance of the essential principles of alphabetic construction, is it to be supposed that they are discoverable by men of the lowest grade in the scale of intellect, and destitute of all external aid, such as those to whom the independent invention of alphabets has been attributed? But although a knowledge of what is essential to an alphabet is not necessary to the making use of one already formed, or to the deriving from that one others by imitation; yet it is obviously requisite to the original and independent formation of any such system.

Still further I have to remark, that with human inventions there is always connected something subject to external observation, which consequently leaves room for the operation of what is called accident or chance in their production; and that it is only from small beginnings that they ascend by gradual improvement to great and noble specimens of art. But in the imaginary case of the independent contrivance of an alphabet, there is nothing external upon which observation can act, till after some system of phonetic signs is constructed; and the getting at the first principle of the construction is by far the most difficult part of the entire problem. The articulate sounds of language are much too numerous and too fleeting to form of themselves an immediate subject for classification; and no remedy can be derived from the substitution of signs, unless they be chosen in such a manner as to avoid the use, to any considerable extent, of homophones or diaphones, that is, of different signs for the same sound or of the same sign for different sounds. But experience shows that mankind are quite incapable of attending to this caution till they are acquainted with the reason for it, or till they have the advantage of an example to follow, which latter aid is

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excluded on the supposition of an independent invention. Here, then, lies one of the many and, as I conceive, insurmountable difficulties of the imaginary case under consideration. Man cannot construct an alphabet, by his own unaided powers of intellect, till he has discovered the principle of its construction; and he cannot find out the principle until he gets under his observation a system of signs, selected according to this very principle of which he is as yet ignorant. Whether the reader will be more struck with this difficulty than with those previously submitted to him in the part of my work which has already been published, I cannot take upon me to determine; but I am induced to place the subject before him in different points of view, in the hopes of gaining his assent to the correctness of one way of considering it, if not of another. I do not, however, expect him to acquiesce in mere abstract reasoning unsupported by actual experience. What I principally rely on, is the fact that, not merely no alphabet has ever yet been proved to have been produced by the independent contrivance of man, but also every alphabet for which such origin is claimed can be clearly shown from its own nature to be a derivative one. I have already established, I will venture to say, beyond a doubt, and by the strongest evidence, both internal and external, the Greek origin, as well of the alphabetic writing of the Egyptians —to which, by the way, they never attained till after their conversion to Christianity,—as also of the phonetic writing previously employed by them in their hieroglyphic system. I shall now for like purpose proceed to the consideration of the Sanscrit alphabet.

This alphabet is here exhibited in the character (in which it is principally written) called *Deva-nagari*, which signifies, according to some authors (for all are not agreed upon the point), "the written language of angels." This meaning of the term is just worth noticing on account of the accordance of the opinion it implies with that which almost universally prevailed in the ancient world, of letters having been a gift to man from some one or other of the gods. The diffusion of this notion through countries and ages so widely separated asunder seems to indicate the remains of an early tradition on the subject, and consequently tells somewhat in favor of the divine origin of the first alphabet, though not of those for which the honor has been claimed by pagan nations. The letters of the system now to be considered are arranged as follows, the power of each being placed immediately under it.

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Sanscrit Alphabet.

अ	आ	इ	ई	उ	ऊ	ऋ	ॠ	ऌ	ॡ
ă	*ā*	*ĭ*	*ī*	*ŭ*	*ū*	*rĭ*	*rī*	*lĭ*	*lī*

ए	ऐ	ओ	औ	अं	अः
e	*i*	*o*	*ou*	*an*	*ah*

क	ख	ग	घ	ङ
ka	*kha*	*ga*	*gha*	*na*
च	छ	ज	झ	ञ
cha	*chha*	*ja*	*jha*	*na*
ट	ठ	ड	ढ	ण
ta	*tha*	*da*	*dha*	*na*
त	थ	द	ध	न
ta	*tha*	*da*	*dha*	*na*
प	फ	ब	भ	म
pa	*pha*	*ba*	*bha*	*ma*
य	र	ल	व	—
ya	*ra*	*la*	*va*	
श	ष	स	ह	क्ष
sha	*sha*	*sa*	*ha*	*ksha*

The first ten vowels are arranged in pairs in which the short or close state of the sound precedes the long or open one. By the open *a* is meant either that which occurs in the word *father* or that in *water;* by the open *i*, the pronunciation of this vowel which is used in *machine;* by the open *u*, that in *rule;* by *e*, the open power of this vowel which occurs in *they* or *there*, not the close one in *then;* by *o*, the open sound of it in *hope*, not the close one in *hop;* by the last *i*, and by *ou*, the English sounds of those letters, as in *wine*, *pound;*—sounds nearly unknown in the Shemitic languages or those of the western continent of Europe, which the English have derived from their German ancestors (though they do not express them by the same letters), and which are common to the German, the Greek, the Sanscrit, and the Chinese colloquial systems.

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The first twenty-five of the characters which follow the vowels are arranged very methodically, in horizontal lines, according to the organs with which they are pronounced;—those in the first line being looked upon as gutturals; those in the second, as palatals; those in the third, as linguals; those in the fourth, as dentals; and those in the fifth, as labials;—and in columns, so that the second and fourth columns should give the corresponding powers of the first and third with the addition of an aspiration, and the fifth column the nasal sounds of the several series. The first N of the nasal column (as likewise its equivalent, the N by which the fifteenth vowel is terminated), corresponds in power with the *ng* of the word *thong;* the second, or palatal N, has a power somewhat resembling that of *ng* in the word *engine.* The third N differs probably but little in power from the fourth (which agrees with ours), as, in the course of derivation and inflection, it is usually changed to that fourth. The addition of *h* to the power of a letter does not produce the same effect as with us; for instance by ph*a* is not meant a sound having any resemblance whatever to f*a*, but merely p*a* uttered with a strong emission of the breath; whence some write this power p'h*a*, to distinguish it from what ph*a* expresses in our use of the combination.

From the scheme of the alphabet above given, an European would be apt to suppose it a system of vowels and consonants; but in point of fact it is only a syllabary as it is, for the most part, used by all of the eastern nations, without exception, who write with it. The letters which appears to us as consonants, have not properly consonantal, but syllabic powers; and express syllables ending with the short vowel *a*. When the vowel part of the syllables to be expressed by these letters is different, then their shapes are modified, more clumsily indeed than in the Ethiopic system, but still in a manner precisely analogous. Thus, according as the vowel termination of the syllable denoted by the first letter is changed, this character is written in the following different ways; the articulate sound corresponding to each variety of shape being placed immediately under it.

क	का	कि	की	कु	कू	कृ	कॄ
kă	kā	kĭ	kī	kŭ	kū	krĭ	krī

कॢ	कॣ	के	कै	को	कौ	कं	कः
klĭ	klī	ke	ki	ko	kou	kan	kah

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Each of the other letters undergoes similar modifications of shape, as well as similar alterations of its syllabic power; and the Indian learner is taught to repeat, first the sixteen syllabic powers of the letter क ka in the order here given; next the sixteen powers of the letter ख k'ha in the same order; next the sixteen of the letter ग ga; and so on till he has gone through the sixteen times thirty-four powers of the system. From his being practised to repeat and made to get by heart this collection of 544 syllables as one complete in itself, there is a likelihood that the vowel-letters did not originally belong to his alphabet. I am aware that the present mode of representing the subject is to state, that the vowel-marks by which the syllabic characters are modified, are derived from the vowel-letters;—a representation which is suggested by the analogous appearance of the characters produced from the combination of two or more of syllabic powers,—but there are very few of the letters and marks in question between which there is the slightest visible connexion; and where there is any, it surely may have arisen just as well from amplifying a mark into a letter, as from contracting a letter into a mark. That where such connexion exists it was produced in the former way, is rendered probable not only by the practice above alluded to, but also by the name of the Sanscrit alphabet, viz. केखेा KeKHo, which is evidently derived from the two letters क and ख, just in the same manner as that of the Greek system is from its first two letters, *Alpha* and *Beta*, or that of the Japan series from its first three terms, *I-ro-fa;* whence it would appear that, when this alphabet received its present denomination, k*a* and k'h*a* must have been its first two characters, and consequently that the vowel-letters, which now precede them, must have been subsequently added to the system.

It is quite impossible that men who had formed the syllabic part of this system by their own efforts of thought, could be blind to the immense advantage of resolving it into consonants and vowels, instead of continuing to use it as a set of syllabic signs; the circumstance, therefore, of the Indians still employing it in the latter manner, and particularly of their doing so after they had got vowel-letters, affords, as I conceive, the most conclusive evidence that they did not arrive at it by invention. But I have discussed this point so fully in the case of the Ethiopic syllabary, that it is unnecessary for me to dwell upon it here, any further than to observe that the arguments previously urged, bear more strongly on the system now under consideration; inasmuch as, from its greater number of

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syllabic powers, the inconvenience of making the inferior use of it is far greater; and also because it is still more easily convertible into a superior alphabet, since it is not merely the case that its characters are obviously resolvable into sets corresponding to the elements of the syllabic powers, but they are virtually so resolved since the introduction of the vowel-letters; and all that is wanted on the part of those making use of it, is a clear conception of the nature of a consonant.

So far the point is made out from a general comparison of the two syllabaries; but there are particular considerations, applicable to the Sanscrit one alone, which lead very forcibly to the same result. In the first place, that this syllabary is not an invention of the Hindoos, is quite obvious even from the single circumstance of its being unsuited to their language; for it cannot be applied to the expression of all Sanscrit syllables, but merely serves to denote those which begin with a consonantal power; and, consequently, must have been derived by imitation from some foreign system connected with a tongue which, like the Ethiopic, includes no articulate sounds except such as are of the latter description. In the second place, it is positively absurd to suppose this people to have invented their syllabary unless they had a distinct idea of consonantal powers; for it would be altogether impossible for them to determine the syllabic sounds to be reduced to a common class without their clearly perceiving what was common to those sounds. For instance, supposing the arrangement of their syllabary to be entirely their own work, unaided by the observation of any prior system, how could they possibly have selected the syllables kă kā, kĭ kī, kŭ kū, &c. as those to be represented by a common character variously modified in shape, unless they had a distinct conception of the proper power of *k*? But that they have no such conception of this or any other consonantal power, is evident not only from their foregoing in the greater part of their writing the advantages of a superior alphabetic system, but also more immediately from what is known respecting their mode of considering the subject. For instance, whenever any of their characters is not modified by a vowel mark, they consider it as the sign of a syllable ending in *ă*, and say that *ă* is essentially inherent in it; evidently thereby showing that, as they are unable to utter any articulation without the help of some vowel-sound, so they are unable even to conceive it without the same help. Again, when a character

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is of necessity used by them in a manner in which it would be looked upon by us as a consonant, that is, when it closes the syllable expressed by the preceding character, and is pronounced by the aid of the vowel part of that syllable, dropping its own vocalic power,—in which case an Ethiopic character is also necessarily used as a consonant;—they then call this letter कंदीत KănDĭT, i. e. *curtailed;* and so make it perfectly obvious that they do not look upon the power of a character in any other light than as syllabic, even when the circumstances of the case would appear almost to force upon them a different conception of the subject.

Here I have to notice a circumstance, which seems in some measure at least to indicate, that the framers of the alphabet before us were persons habituated to hieroglyphic writing. In the Sanscrit language there occur several articulate sounds commencing with a combination of two or even of three consonantal powers, and which are, in consequence expressed by the Pandits by combinations of two or three of their syllabic characters.* Each of those combinations is reduced to a single character, for a reason which shall presently be considered; but the point to which I now wish to draw attention is, that in the reductions in question, very little care is shown to preserve any likeness of the resulting compounds to their component characters. In most of the compositions not more than one of the ingredient letters can be recognized,—at least by those who are not very skilful in the analysis;—and the consequence is, that the learner has thrown upon him very unnecessarily the burden of committing to memory a great number of additional characters, which it is as difficult for him to fix in his thoughts as if they had no relation whatever to those simpler ones with which he was previously acquainted. Such indifference on the part of the framers of the system to the numbers of extra-characters with which they encumbered it, looks very like the effect of familiarity with a species of writing in which the amount of symbols is indefinite. In support of this view of the subject may be noticed the superabundance of letters in the alphabets of the Siamese and Tonquinese,—

* In this case also, the characters—that is, all except one of them in each combination,—drop the vowel part of their powers, and so must practically have suggested to the Pandits some idea of consonants; though they have failed to excite a clear one, as is evident from what has been already stated.

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a deterioration of their respective systems, which is obviously attributable to the influence upon their phonetic practice produced by the habit of Chinese writing; —and as the like effect is observable in the Sanscrit system, we cannot rationally avoid ascribing it to a like cause. Hence it would appear, that the Sanscrit writing was the first of an alphabetic nature that was employed by the Brahmans; and that they had no previous syllabary of a ruder kind devoid of all marks expressive of vowel powers.

We now come to the inquiry, whence was this alphabet derived?—the answer to which, I must premise, I do not feel myself called upon to give. All that is requisite to my theory as to the origin of alphabetic writing, is to show that the system in question is a derivative one; and of so much, I trust, the reader has been already satisfied.—As a matter, however, of curiosity I enter upon this investigation, and confess I shall be disappointed if the considerations, here proposed, are not looked upon as going a great way towards deciding the point at issue.

In the first place, the Sanscrit syllabary could not have been derived from any of the Shemitic kinds of vocalized writing, employed in Asia, which have come down to our times. For in all those different kinds, a vowel letter is occasionally used immediately after another character to express in conjunction with that character a syllable; but such a mode of expression *never* occurs in Sanscrit. Whenever in this writing a complete vowel-letter follows another character, they always denote two different syllables; and are not united in the expression of the same one, even when that preceding character is destitute of any vowel-mark of its own. Thus बढई, *a carpenter*, is not pronounced BăDHI, but BăDHăI. I do not here take into consideration the great imperfection of this writing, as exemplified in its use of the middle character of the group before us to express sometimes the syllable dh*a*, and at other times r*a*, without any rule being afforded to determine when it should be employed with the one power and when with the other; I merely advert to the vowel sounds of this word in illustration of the peculiarity just mentioned.

In the second place, the syllabary under consideration could not have been derived from the Greek or Roman systems; for from them the Pandit would have learned to write in the European manner the syllables of his language ending with a vowel, as well as those beginning with one; the very reverse of

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which has been above shown to be his practice. If it be asked why might not the Sanscrit as well as the Ethiopic syllabary be derived from the Greek method of writing, I have to reply, that in the Ethiopic tongue there are no syllabic sounds commencing with a vowel; it cannot, therefore, be ascertained that the Abyssinian would have expressed such sounds otherwise than he does those which are actually employed by him, and the natural presumption is, that he would have denoted them just in a similar manner; whereas the Hindoo has in his learned language syllables of both kinds, and writes those syllables in wholly different ways.

In the third place, the European and older Asiatic alphabets having been rejected as the immediate sources of the Sanscrit syllabary, it remains to be inquired whether this syllabary may not be the offspring of the Ethiopic system. Here the marks of near relationship are certainly very stroug. Some of them perhaps may strike the reader's judgment less forcibly than others; but how he can resist their united evidence, I confess I do not see. I shall now submit to him, in a connected series, the different points of resemblance between the two systems which their comparison has suggested.

1°. Although, in modern practice, two of the Ethiopic characters are represented as letters each of which is, by its several modifications, expressive of the whole series of vowels; yet it has been shown that, in the ancient use of this system, it was a pure syllabary, containing no letters but such as were of syllabic powers; and it has been equally shown that the Sanscrit system also was at first a syllabary of exactly the same general nature.—2°. In the Ethiopic syllabary all the syllables expressed by the several letters begin with an articulation, and end with a vowel-sound; in the Sanscrit syllabary likewise all the syllables it expresses by single letters, begin with an articulation, and end with a vowel-sound, or with what is considered as such by the Pandits; although it is to be observed, that there are several simple syllables of their language which do not come under this description, and which, therefore, cannot be represented by means of their syllabary.—3°. In the Ethiopic syllabary certain changes in the shape of each letter denote certain changes in the termination of its syllabic power, and like modifications of shape in different letters indicate like terminations of their different powers. Now this description equally applies to the process which takes place in the Sanscrit syllabary; the modifying marks,

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indeed, are different, but the principle which directs their signification is precisely the same.—4°. In the Ethiopic syllabary each of the letters, taken in its simplest form without any modification of shape, denotes a syllable ending in a short *a*; and in like manner each letter of the Sanscrit syllabary denotes, in its unmodified state, a syllable ending in a short *a*.—But to compare more closely the corresponding series of powers in the two systems, we should conceive those of the Sanscrit syllabary to be arranged in the same manner as the Ethiopic ones are in the table which has been given of the latter; that is, each set of the Sanscrit powers of a common commencement to be placed in the same horizontal line, and each set of those of a common termination to be in the same column; and still farther, we should reject the six columns introduced by the Pandit through gross ignorance of the nature of a vowel, as well as the two columns he has added to his system on account of vowel sounds occurring in his, but not in the Ethiopic language. Then it may be observed—5°. The syllables of the first column in both systems end in *a*.—6°. The syllables of the last column in both systems end in *o*.—7°. To conclude this comparison, let us bring together the powers belonging to any two of the equivalent letters of the two systems. For instance, the powers of the letter *Bet* are placed by the Ethiopian in the following order:

bă bu bi bā bē bĕ bo

and the powers of the same letter (when we reject those which do not really begin with a single consonant and end with a vowel, as also those which end with vowels not used in the Ethiopic tongue) are arranged by the Pandit thus:

bă bā bĭ bī bŭ bū be bo

There are three vowels exhibited in a twofold state in the latter series, and only two in the former; but when the distinction was introduced in any one instance it was easy to extend it to others.* It is also to be noted, that although the

* The correctness of this observation is practically illustrated by a recent publication of Captain Henry Harkness, in which he has given copies of several syllabaries that are used in the southern part of the Indian Peninsula, and are derived from the Deva-Nagari system. In four of these, namely, in the *Telugu*, the *Karnataka*, the *Malayalma* (which is the same as the *Tuluva*), and the *Tamizh* syllabaries, the vowels E and O, as well as A, I, and U, are considered, each of them, in a twofold state; and the consequence is that, in the first three of the derivative systems just mentioned, there are no less than eighteen columns, or eighteen varieties of the syllables denoted by the

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powers including *i* and *u* are next to each other in both series, yet they are not in the same order; and that the syllables exhibiting the two states of *a*, are separated from each other in the former series. In consequence of these differences a perfect identity of the two systems cannot be maintained; but still there is left between them a degree of resemblance that is highly remarkable; and when it is considered how very singular is the arrangement of the terms in the former series, and that the resemblance in question holds not only between it and the latter one, but also, as far as the vocalization is concerned, between all the series of the two systems, it will be found quite beyond the range of probability that the second system could have been formed without a knowledge of the first.

But the extraordinary similarity of the Ethiopic and Sanscrit syllabaries,—a similarity, indeed, that would be utterly inexplicable and nearly miraculous, if one of them was not derived from observation of the other—holds not only in the nature of the two systems as now unfolded, but also in their application, and that too even in cases where it was very difficult to contrive a way of preserving it. In the Ethiopic mode of writing, a syllable is always expressed by one or two characters, according as it ends with a vowel or consonantal power; and in the Sanscrit method likewise, a syllable is always denoted by one or two characters, according as the Pandits look upon its termination as a vowel or a curtailed syllabic power. In the former system, in which every syllable of the language connected with it begins with a simple articulation, this mode of expression is quite natural; but in the latter system, in the employment of which syllables are often to be written which commence with a combination of two, or of three consonantal powers, it is obviously a very forced one. Yet even in such cases the Hindoo writer adheres to the model placed before him by the Ethiopic practice; and with that view—for it is inconceivable that the mutilation could have origi-

several letters; but in the *Tamizh* system there are only twelve columns, the six which were introduced by the Brahmans through gross ignorance of the subject, being in this syllabary rejected. The *Grantha* syllabary is the only one of those given by Captain Harkness, in which the series of syllables denoted by each letter is precisely the same as in the Sanscrit system; they are, however, all the rest as well as the Grantha one, ascertained to be derived from this system; and yet in all of them, it deserves to be remarked, the letters are entirely different in shape from the Deva-Nagari characters. This circumstance verifies an assertion I have already made upon the subject; and the publication shows by special examples the justness of the remark, that, in tracing the origin of any alphabetic system, we should attend far more to the powers with which the letters are used, than to their shapes.

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nated in any other motive,—whenever he has to write a simple syllable or the commencing part of a compound one with two or three characters, he always jumbles fragments of those characters together, so as to reduce them to a single letter. Upon the whole, when all the circumstances of minute correspondence in the systems themselves, and in the use made of them, are taken into account, I am in hopes that the connexion which I assign to them will be considered as established nearly to a certainty, and I feel warranted in asserting that we cannot rationally come to any other conclusion on the subject than the following one; namely, that as the Ethiopic syllabary is derived partly from a Greek, and partly from a Shemitic origin, so the syllabic part of the Sanscrit system is derived from that syllabary.

With respect to the vowel-letters of the Sanscrit alphabet, it is not impossible but that their formation may have been suggested to the Hindoo by the vowel-marks he had previously adopted in imitation of those employed in the Ethiopic syllabary; and their shapes must, I apprehend, be considered as exclusively his invention. But for the use he makes of them he is indebted, certainly not to his own reach of thought, but merely to his observation of some foreign example. When he places them before the characters of the first column of his syllabary in order to express syllables, the two sets of letters thus combined, become virtually in his practice, I admit, the elements of a superior alphabet; but they are not distinctly such in his apprehension of the subject. That he has only a confused and obscure idea of vowels is obvious from his including among them the sounds expressed by *rī*, *ṛi*, *ḷi*, *ḷī*, *ang*, *agh*; and that he has a still more imperfect conception of consonants is equally plain from the name he gives his characters of "curtailed" or "incomplete," when used as such. The idea of a consonant in the mind of a person who understands its nature, is just as complete as that of a syllable; what a letter of this kind denotes, indeed, is not a sound, but merely a capability of modifying sound, on which account it is called a "power." But the letter in respect to this power is complete; and it is only when it is referred to an actual syllabic sound, instead of to a mere potential element of such sound, that it can be looked upon as curtailed or incomplete. What, however, I principally rely on in proof of the Pandit's indistinct apprehension of the nature of an alphabet of vowels and consonants, and of the consequent impossibility of his having made out himself that which he employs, is the circumstance of his

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continuing to use the syllabary after he had attained to the superior system; which he certainly would not do, if he had as much knowledge of the subject as must have been acquired in rising from the one system to the other by his own mental exertions. Indeed, even as the case stands, and admitting that he was ever so passive and inert in his mode of receiving from some external source of instruction the superior use of his letters, it is wonderful that the practical experience of the benefit of that use did not make him extend it through the whole of his writing; and his retaining the syllabary can, I conceive, be accounted for only on the supposition of his having been long habituated to it before he was taught the more perfect system. This supposition cannot, indeed, be verified by actual observation, since there is not, as far, I believe, as has been yet ascertained, any Sanscrit writing now extant in which there are not vowel letters; but still it rests upon inferential grounds of some strength, and the probability is, that the syllabary alone was made use of for a long time before this writing reached the very curious and extraordinary state in which it is now presented to our notice, with the elements continually blended together in it of two alphabets of wholly different kinds.*

The Indian, however, had particularly strong inducements to introduce the use of the superior alphabet into his writing, and we may be certain that he did so, as soon as ever the improvement was suggested to him; because there are several syllables of his language that he could not express by means of his syllabary. This imperfection, indeed, may to a lesser extent be observed in the graphic practice of the Ethiopian; of which I have given an instance in his mode of writing the Greek word Ἱερουσαλήμ, the second vowel of which he was obliged to represent by the sound of the syllable *ya;* but as it affected only his

* The Sanscrit scholar may perhaps be surprised at finding it stated, that there is any incongruity in the ingredients of this writing. For, from the facility with which he conceives consonantal powers, he insensibly acquires the habit of at once mentally resolving the syllabic letters he meets with, into consonants and vowel signs; whence he is brought to look upon the whole series of characters which occur in any Sanscrit text, as belonging to an alphabet of one kind, and as differing from the general nature of European writing only in the circumstance of being partly contracted. But the writing in question is in this Essay considered, not as the European, from his superior expertness in reading, is enabled to view it; but as it is in itself, and as it appears to the apprehension of a native reader, taught according to the native method of instruction.

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expression of foreign names, it was not productive to him of any serious inconvenience. On the other hand, the case is very different with respect to the Indian, and the wonder excited by his writing is, not that he adopted a new method of using his letters, but that he did not extend that method throughout the entire of his practice. Had he done so, no possible means would have been left of now discovering the origin of his first alphabetic writing. As to the second kind, which he mingles with the first, he could not have learned it from observation of any Asiatic writing; for in none of the Shemitic class of languages is there afforded an example of syllables beginning with a vowel.* The superior part of his system must, therefore, be traced to an European source; and as he had more intercourse with the Greeks than the Romans, he probably derived it from the writing of the former people.

It has been already mentioned on the authority of Rufinus,—who lived near the time of the event to which I allude, and had his information immediately from the very companion of the person who was principally engaged in bringing it about;—that the Abyssinians were not converted to Christianity, and did not receive the Greek Scriptures till the year of our era 335.† And it has also been proved that the vocalization of their syllabary originated in their acquaintance with Greek writing. From both circumstances combined it follows that, in all likelihood, this syllabary did not attain to the state in which it has been transmitted to us till after the middle of the fourth century; and, consequently, that the formation of the Sanscrit syllabary was not commenced till a still later epoch. If it be objected to the former part of my conclusion, that the Abyssinians may

* Arabic and Persian syllables beginning with an *Halif* are now usually represented in Roman letters as commencing with the vowel A; but this oriental letter had originally an aspirate ingredient in its power, as may be known from its prototype the Hebrew *Haleph*. In like manner the Hebrew *Waw*, which, when used to express a conjunction, is generally read by the syllable Wă, is in some particular cases pronounced simply as the vowel U. But in such cases the old pronunciation of the conjunctive sign was Wu; and it was only from the difficulty of making the consonantal part of this syllable perceptible in rapid utterance, that in the course of time it came to be dropped.

† Their translation of the Bible shows to a certainty, that, when they made it, they were unacquainted with the original Hebrew text, which they could not have been if they then were of the Jewish religion. They must, therefore, have been converted to Christianity from Paganism, and consequently, on that occasion have received for the first time the Greek version of the Old as well as of the New Testament.

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have learned Greek writing before the Septuagint version of the Bible came into their possession, I am quite ready to admit that they were previously in habits of communication with the Egyptians when under the dominion of Greeks, and subsequently of Romans, who, from their artful policy, still continued to make use of the same European writing as their predecessors in the Egyptian documents of state. But the Egyptians themselves, as I think any one who reads the first volume of my work with attention must clearly see, acquired no knowledge of the nature of alphabetic writing till they became Christians. Before that event took place, their writing, like that now employed by the Chinese in the expression of foreign names, was beneath the very lowest grade of syllabary; for it failed in the essential requisite of being limited to a fixed determinate number of signs. Beyond this defective system they never advanced till they were induced more particularly to study the Greek written language, in consequence of its having become to them the medium of religious instruction; and then at length they arrived at the construction of the Coptic alphabet. It is, therefore, utterly improbable that the Abyssinians, who had far less intercourse with Greeks, and who, besides, were a very indolent people, should have attained to such a familiarity with the Greek method of writing as enabled them to introduce from it a very important improvement into their own, until they were by a similar inducement led to pay some attention to the nature of that method.

A limit to the age of the Sanscrit alphabet having now been fixed, the next point to be investigated is, whether this limit harmonizes with history; not, I mean, with the boasting accounts of the Brahmans, upon which no sort of dependance can be placed, but with those of writers uninfluenced upon the subject by any motives of national prejudice or partiality. That long before the time when, according to the above representation, the Indians may be supposed to have completed their alphabet, they had intercourse with the Greeks and even with the Romans, is matter of historic record of unquestionable authority; and is besides, in reference to the latter people, corroborated by the recent discovery of Roman coins that must have been buried in India before the end of the second century.*

* In the second volume of *Asiatic Researches*, page 332, is inserted a letter,—of Alexander Davidson, Esq., dated Madras, July 12, 1787,—from which I give the following extract:—"As a peasant near Nelor, about 100 miles north-west of Madras, was ploughing on the side of a stony, craggy hill, his plough was obstructed by some brick-work. He dug, and discovered the remains of

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Many instances of discoveries of the kind, it is probable, might be adduced; but it is unnecessary to search for further confirmation of a fact that is already sufficiently established. What the inquiry more calls for, is to ascertain whether, previously to the limit of time assigned to the first formation of the ruder part of this alphabet, any communication was carried on between the Indians and Abyssinians.

Now the first circumstance that would, I think, be apt to strike one here, is the remarkable similarity between the distribution of men into castes in India and that which formerly subsisted in Egypt, as described by Herodotus* and Diodorus Siculus.† The Greek historians indeed were not agreed as to how many of those castes there were in the latter country, nor are the modern writers as to how many there are in the former; it is no wonder, therefore, that the accounts we have of the number of classes in the two systems of arrangement should be somewhat different, though even, as respects this point, there is the remarkable correspondence of the priests constituting the first caste, and the soldiers the second in both systems. But the extraordinary principle of compelling every man to follow the same profession and way of life that his father had done, and never allowing him under any circumstances to change his occupation, is common to the two institutions. Herodotus records the enforcement of this regulation with respect to the class of soldiers,‡ and he implies it as to the rest by calling them distinct *races* of men; but Diodorus Siculus extends it

a small *Hindu* temple, under which a little pot was found with Roman coins and medals of the second century..... This happened while I was governor [of Madras], and I had the choice of two out of the whole. I chose an Adrian and a Faustina. Some of the Trajans were in good preservation. Many of the coins could not have been in circulation; they were all of the purest gold, and many of them as fresh and beautiful as if they had come from the mint but yesterday."

* Ἔστι δὲ Αἰγυπτίων ἑπτὰ γένεα. καὶ τούτων, οἱ μὲν, ἱρέες, οἱ δὲ, μάχιμοι κεκλέαται· οἱ δὲ, βουκόλοι· οἱ δὲ, συβῶται· οἱ δὲ, κάπηλοι· οἱ δὲ, ἑρμηνέες· οἱ δὲ, κυβερνῆται. γένεα μὲν Αἰγυπτίων τοσαῦτά ἐστι. οὐνόματα δέ σφι κέεται ἀπὸ τῶν τεχνέων.—*Herod.* lib. ii, cap. 164.

† Instead of the last five classes of Herodotus's division, Diodorus substitutes three, as follows: Ἔστι δὲ ἕτερα συντάγματα τῆς πολιτείας τρία, τό, τε τῶν νομέων, καὶ τὸ τῶν γεωργῶν, ἔτι δὲ τὸ τῶν τεχνιτῶν.—*Diodori*, lib. i, p. 67.

‡ Οὐδὲ τούτοισι ἔξεστι τέχνην ἐπασκῆσαι οὐδεμίην, ἀλλὰ τὰ ἐς πόλεμον ἐπασκέουσι μοῦνα, παῖς παρὰ πατρὸς ἐκδεκόμενος.—*Herod.* lib. ii, cap. 166.

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expressly to every class of persons in the body politic of Egypt.* It is not at all likely to have occurred to different nations independently of each other to impose upon human conduct so unnatural a restraint. And from this consideration alone, without entering upon minor points of resemblance which have been observed in architecture and in some other respects, it is, I conceive, fairly deducible that a connexion must have subsisted of very ancient date between India and Egypt; and if so, *a fortiori*, between India and Abyssinia,—a country that lies in the direct line of communication between the other two, according to the coasting mode of making voyages which was practised in ancient times.

But to trace this connexion nearer to the epoch under consideration;—we find Strabo in the first century stating, "that in his time the trade of the East with Europe was conducted chiefly through Alexandria; that the merchandize from Arabia and India was landed at Myos-hormos (literally Mouseport, a harbour on the western coast of the Red Sea, not a great deal farther from Axum, the capital of Abyssinia, than from Alexandria); that thence the lading [of the vessels] was conveyed to Coptus in the Thebaid, by camels, or on a canal of the Nile; and thence to Alexandria."† Here again, the intercourse between India and Abyssinia is, I admit, made out only by implication; but Montfaucon's collection of Greek writers enables me to prove directly by the express evidence of Cosmas, surnamed Indicopleustes, that it subsisted not long after the time in question. Cosmas was an Egyptian monk of Alexandria, who had previously been a merchant, and had travelled in that capacity through both India and Abyssinia. In the latter part of his life, during the reign of the Emperor Justinian, or about the middle of the sixth century, he wrote his *Christian Topography*, which has been published in the second volume of the above-mentioned collection. His attempt, indeed, to prove from Scripture that the earth is a flat surface of the shape of an oblong parallelogram, of which the

* After separately stating of each class, that it was subjected to this regulation, Diodorus subjoins the following more general account of the matter:—Τὴν μὲν οὖν διαίρεσιν τῆς πολιτείας, καὶ τὴν τῆς ἰδίας τάξεως ἐπιμέλειαν διὰ προγόνων τοιαύτην ἴσχυν οἱ τὸ παλαιὸν τὴν Αἴγυπτον κατοικοῦντες.—*Diodori*, lib. i, p. 68.

† —— νυνὶ δὲ τὸ πλοῖον εἰς τὴν Ἀλεξάνδρειαν τῷ Νείλῳ κατάγεται· τὰ δ' ἐκ τῆς Ἀραβίας καὶ τῆς Ἰνδικῆς εἰς Μυὸς ὅρμον· εἶθ' ὑπέρθεσις εἰς Κόπτον τῆς Θηβαΐδος· καμήλοις, ἢ διώρυγι τοῦ Νείλου· ἐκεῖθεν δ' εἰς Ἀλεξάνδρειαν.—*Strabonis*, lib. xvi, p. 781.

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length from east to west is double that from north to south, is very absurd; but he shows an intimate acquaintance with the circumstances of the countries in which he resided as a merchant, and there is no reason to doubt his testimony as to facts that must have come under his own observation. In the second book of his treatise he gives the following account of the African trade with India. "There is a region producing frankincense in the extreme parts of Ethiopia, being inland, but having the ocean farther on, whence those inhabiting Barbary [he so calls the country between that previously spoken of and the ocean], as being near, entering into the inland places and trafficking, bring from them most of the spices, as well as frankincense, cassia, aromatic reed, and many other things; and the same persons again convey them by sea to Adule [the seaport of Axum], and to the Homerite district [one immediately bordering on Abyssinia], and to the inner India and Persia."* Here we have it asserted in express terms that a traffic was carried on from the principal seaport-town of Abyssinia and from the country which adjoins it, to the inner India; that is, to the Asiatic India, which was so called to distinguish it from a part of Africa which formerly had the same general denomination. It is not to be supposed that the Barbary navigators went directly across the sea to India, but in the mode of voyaging that was then in use they must have gone first to Adule, then along the coasts of Arabia and Persia, and in the last instance along those of India.

I subjoin another passage from the third book of the Christian Topography of Cosmas, not only on account of the allusion it contains to his having himself made this very voyage, but also because it shows the extent to which Christianity,

* Ἔστι δὲ ἡ χώρα ἡ λιβανωτοφόρος εἰς τὰ ἄκρα τῆς Αἰθιοπίας, μεσόγειος μὲν οὖσα, τὸν δὲ Ὠκεανὸν ἐπίκεινα ἔχουσα. ὅθεν καὶ οἱ τὴν Βαρβαρίαν οἰκοῦντες, ὡς ἐγγύθεν ὄντες, ἐνερχόμενοι ἐπὶ τὰ μεσόγεια καὶ πραγματευόμενοι κομίζουσιν ἐξ αὐτῶν τὰ πλειστὰ τῶν ἡδυσμάτων, Λίβανον, Κασίαν, Κάλαμον, καὶ ἕτερα πολλά· καὶ αὐτοὶ πάλιν διὰ θαλάσσης κομίζουσιν ἐν τῇ Ἀδούλῃ, καὶ ἐν τῷ Ὁμηρίτῃ, καὶ ἐν τῇ ἐσωτέρᾳ Ἰνδίᾳ, καὶ ἐν τῇ Περσίδι.—*Montfauc. Collec. nov.* lib. ii, pp. 138-9. There is an ambiguity in this passage, in consequence of ἡδυσματα bearing the meaning of "seasonings for the taste," or that of "perfumes." If the word have here the former, which is the more appropriate signification, the articles of trade which follow it must be considered as additional ones; but if it have the latter, then the frankincense, cassia, and reed are subjoined merely as specimens of the ἡδυσματα. However this may be, it is plain from the account of Cosmas, that in the sixth century India imported from Africa commodities, which she now exports of her own growth.

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and consequently the Syriac writing, was spread through India in the sixth century. "In the Island Taprobana [that is, Ceylon. Our author elsewhere tells us that what was called Taprobana by the Greeks, was named Selediva by the Indians.* But Selediva, in the language of the country, means the island, *Sele*, or, as the word is now pronounced by Europeans, *Ceylon*] adjoining to the inner India, where the Indian Sea is, there exists a church of Christians, including both clerics and lay-believers; whether it extends still farther I do not know. In like manner it exists in the region called Male [that is, in Malabar; for *Male barr* means, in the language of the country, the main land, or continent, *Male*], where the pepper is produced; and in that called Calliana [it is uncertain what district this may be; Montfaucon conjectures, it is that of which Calicut is the principal emporium] there is moreover a bishop elected from Persia. In like manner also, in the island called Dioscorides [which still retains the same name, only that it is corrupted into Socotora or Socotra], situated in the same Indian Sea, where the inhabitants, colonists planted by the Ptolemies, successors of Alexander the Macedonian, speak Greek, there are both clergy (elected from Persia, and sent into those parts), and also a multitude of Christians. Which island we sailed by, but I did not land on it; with certain persons, however, of those using the Greek language, I kept company as they were proceeding to Æthiopia."†

Thus, I apprehend, an intercourse between the Indians and Abyssinians about the time of the formation of the older part of the Sanscrit alphabetic system, and long before, has been sufficiently made out. The similarity, indeed,

* —— τῆς νήσου τῆς καλουμένης πορὰ μὲν Ἰνδοῖς, Σιλεδίβα, παρὸ δὲ τοῖς Ἕλλησι, Ταπροβάνη.—*Montfauc. Collec. nov.* lib. ii, p. 137.

† Ἐν τῇ Ταπροβόνῃ νήσῳ ἐν τῇ ἐσωτέρᾳ Ἰνδίᾳ, ἔνθα τὸ Ἰνδικὸν πέλαγός ἐστι, καὶ ἐκκλησία χριστιανῶν ἐστὶν ἐκεῖ καὶ κληρικοὶ καὶ πιστοὶ, οὐκ οἶδα δὲ εἰ καὶ περοιτέρω· ὁμοίως καὶ εἰς τὴν λεγομένην Μαλὲ, ἔνθο τὸ πέριρι γίνεται· καὶ ἐν τῇ Καλλιάνᾳ δὲ τῇ καλουμένῃ, καὶ ἐπίσκοπός ἐστιν ὀπὸ Περσίδος χειροτονούμενος. Ὁμοίως καὶ ἐν τῇ νήσῳ τῇ καλουμένῃ Διοσκορίδους κατὸ τὸ αὐτὸ Ἰνδικὸν πέλαγος, ἔνθο καὶ οἱ παροικοῦντες Ἑλληνιστὶ λαλοῦσι, πόροικοι τῶν Πτολιμαίων τῶν μετὸ Ἀλέξονδρον τὸν Μακεδόνο ὑπαρχόντων, καὶ κληρικοί εἰσιν ἐκ Περσίδος χειροτονούμενοι καὶ πεμπόμενοι ἐν τοῖς οὐτόθι, καὶ χριστιανῶν πλῆθος· ἣν νῆσον παρεπλεύσαμεν, οὐ κατῆλθον δὲ ἐν αὐτῇ· συνέτυχον δὲ ἀνδράσι τῶν ἐκεῖ Ἑλληνιστὶ λολοῦσιν, ἐλθοῦσιν ἐν τῇ Αἰθιοπίᾳ.—*Montfouc. Collec. nov.* lib. ii, pp. 178-9.

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of the writing of the two people, in a great variety of points which could not have occurred to different parties independently of each other, proves the reality of that intercourse beyond a doubt, whether we could account for it or not; but the being able to trace it, and to show that the supposition of its existence is accordant with the evidence which history supplies, is satisfactory to the inquirer's mind. Should it be asked,—if the Indians had communication with alphabetic writers for such a length of time before, why did not they sooner construct their alphabet,—the delay is, I think, sufficiently accounted for by the examples of the Egyptians and Chinese; upon consideration, indeed, of those examples, the ground for surprise will, I conceive, be found, not that hieroglyphists were so slow in setting about framing a syllabary, but that they framed one at all. A reason, however, for the difference in this respect between their case and that of other people long habituated to hieroglyphs, will presently be adduced. If again it be asked, why, having the power of selecting from three alphabets, did they make choice of the worst as their first model, I answer, they did so *because* it was the worst; because it was of a ruder kind than the European ones, and consequently the powers with which its characters are employed, could be much more easily apprehended by persons who had been previously acquainted only with hieroglyphic writing. And I must add, that, if this model had been commensurate to the expression of their language, they probably would never have gone beyond it; but when the use for some time of the syllabary they had thence derived, rendered them practically more capable of employing a superior alphabet, then the impossibility of expressing all their syllables by means of the part of their system first acquired, forced them in some measure to attend to European practice, and by the imperfect insight they gained into its nature they rose to the second part. Although the Syriac writing, as well as the three kinds just specified, had reached them before the formation of the Sanscrit alphabet, yet I have left it out of consideration among the models to which they may have resorted; because, as it contains consonants, it would, in the first instance, have been as difficult for them to catch a glimpse of its use as of that of either of the European kinds; and, in the second case, as it employs vowel-letters only after consonants, mere observation of the practice followed in it, would not have enabled them to remedy the defect of their syllabary.

If now we turn from this writing to the language to the expression of which

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it was first applied, we shall find very strong additional reasons for curtailing its reputed age;—reasons which are still further strengthened by the consideration that, in yielding to them, we not only get rid of great difficulties—I might perhaps say absurdities—which embarrass the prevailing opinion upon the subject; but also arrive at a rational and consistent explanation of the cause of the original formation of both the verbal and the graphic system of the Brahmans. In the first place, the language in question is by no means of a primitive kind, nor is its grammatical mechanism at all that of an ancient tongue. I admit that in very rude and possibly very ancient languages, long in use before their ingredients were prevented from any further amalgamation by the adoption of alphabetic writing, various groups of words may, by gradual or fortuitous blendings, have been reduced to single terms; and the accumulation of such compounds has the effect of producing great intricacy as well as exuberance of expression. Thus, for instance, in the Basque dialect there are said to be seventeen degrees of comparison, which evidently must have arisen from different combinations of adverbs having, in the rapidity of oral communication, happened to run into each other, in such a manner as not to be separable into their original distinct forms when alphabetic writing came to be applied to them. But the complexedness of the Sanscrit language is not of this nature; a great share of it, at least, has been produced by the extension of technical distinctions to cases to which they do not in strictness apply; so that we find here exhibited a junction of skill and ignorance which is very compatible with the supposition of the Brahmans having imperfectly learned the grammatic art from foreigners, but not at all with that of their having arrived at it originally by means of their own ingenuity. Thus their use of the verb, *to be*, in all the tenses of an active, a passive, and a middle voice, cannot be accounted for by any accidental amalgamations of formative particles with the principal word; and seems as inconsistent with the simplicity of a primitive language as it is with true correctness of thought.* To imagine that a tongue displaying peculiarities of this kind could be very ancient, is at variance with every fair deduction that can be drawn upon the subject from writings which are of acknowledged great antiquity.

* This example will be more particularly considered when I come to show the artificial structure of the Sanscrit language.

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I have already observed that the Hindoo grammarian, as having more intercourse with the Greeks, is more likely to be indebted to them than to the Romans for the completion of his alphabetic system; and from the same quarter he must, I conceive, have learned the very difficult and complicated mechanism which is presented to our notice in the construction of the Sanscrit language. That, betraying as he does, in some respects, considerable ignorance of the general principles of grammar,* he could not himself have discovered the elements of this mechanism, is perfectly obvious; and there is no external source from which he could have derived them except an European one. He could not have been taught them by the Arabians, who did not acquire their own knowledge of grammar till long after the formation of the system in question, namely, till after they had become acquainted with Greek literature; and there is no other Asiatic nation from which, even up to the present day, the requisite information on the subject could be obtained. It is true that, as soon as a people adopt the use of an alphabet, their writings may be made the subject of grammatic analysis by those who are masters of the art; rules may be traced out for ascertaining strictly the meaning with which every expression is used; and a grammar of the language may be formed. But to suppose that the primitive writers whose compositions admit of being thus analyzed, had themselves any conception of the art by which this could be effected, is wholly unwarranted by

* His choice of tenses, and his extending the use of the imperative mood to the first person singular, are, I submit, instances of such ignorance. The tenses of the Sanscrit language are thus given in Mr. Carey's Grammar: "The first tense is the present, the second the present dictative, the third the imperative, the fourth the imperfect, the fifth the perfect, the sixth the preter-indefinite, the seventh the future, the eighth the future benedictive, the ninth the future indefinite, and the tenth the conditional," p. 131. We have here a confusion of moods and tenses quite incompatible with the supposition of the Hindoo having arrived at his theory on the subject, which is in other respects very subtile, merely by his own efforts of thought. Mr. Carey gives the following examples of the use of the Sanscrit imperative in the first person, "Shall I read the Vedă or Tărkă?—I want something to eat," p. 878. Surely when expression is given to the desire implied in each of these examples, the imperative immediately appears in the form belonging to the second person. "Tell me, shall I read the Vedă?"—"Bring me something to eat." The same confusion of thought appears also in the Pandit's selection of moods; which he has fixed to be "the indicative, the causal, the optative, and the frequentative."—*Carey's Gram.* p. 131. If these names be correctly applied, the second and fourth forms of expression are not moods at all. The optative is, indeed, strictly a mood; but where is the use of a benedictive tense in a system in which this mood is employed?

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either experience or reason. The authors of the inspired works which make up the Hebrew Bible, had no knowledge of grammar;—their ignorance of it, indeed, is one of the strongest intrinsic marks of the great antiquity of that sacred book; and the case of Moses bears with particular strength upon the point, as he was the most highly educated man of his day, and skilled in all the learning of the Egyptians;—while on the other hand, the Chinese continue, even up to the present moment, wholly ignorant upon the subject. The latter example proves that letters are indispensably requisite to a knowledge of this art; the former, that they lead to such knowledge only after the lapse of a long series of years. I must defer to a subsequent occasion, as well the unfolding of these examples, so as to show that I have here given a just representation of their nature; as also the reasoning connected with the view of the matter which they supply,—a view which, though novel, will, I trust, be found correct, and agreeing with the real state of the case. For the present I shall confine myself to adducing a case, upon the facts of which there can be little room for difference of opinion; and when those facts are brought to bear upon the point before us, they will, I think, afford a convincing illustration of the great length of time that men would require after the introduction among them of the use of letters, in order to arrive at any degree of grammatic skill by means solely of their own efforts, unaided by external instruction.

The case to which I allude is that of the Greeks, the most ingenious nation, or at any rate one of the most ingenious, of those respecting which we have any historic information; and yet they had the benefit of alphabetic writing near 1100 years before they matured their notions of grammar into a regular art. For nearly such a length of time, it is computed by Sir Isaac Newton, they had letters before the Christian era, and according to the commonly received system of chronology this interval is much greater; but we do not hear of the grammarians as a distinct class of learned men till about the first century. The date, however, of an art's arrival at completion can be more closely determined by its immediate effects, than by the time of its professors first coming into notice; and the calculation made upon this principle will still more forcibly lead us to the same conclusion. One of the most direct as well as useful results of grammatic knowledge was the formation of dictionaries; let us, then, endeavour to trace these through their several stages of improvement, and we shall thus, I expect, be

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brought clearly to perceive, how very slowly the art in which they originated, must itself have advanced. The inquiry, indeed, is even in reference to dictionaries alone, worthy of some attention; and it will besides serve to point out what very little right the Brahmans have to claim any share in the credit of having originally and independently made out this invention,—an invention which they could scarcely have even yet arrived at, if they had been left solely to the resources of their own ingenuity.

The most ancient works of which accounts have reached our days, having any relation to the nature of dictionaries, were commentaries of Greek grammarians on single authors, explaining the "words," used by each author, which had in the course of time become obscure; whence they were called γλῶσσαι. Such, for instance, were the glosses of Homer, of Aristophanes, of Hippocrates, of Plato. Some of these, as for example, Homeric glosses, are still extant; but it belongs to the very nature of such works in the course of successive ages to receive continual accessions; first additional "words" are inserted in the margin, and, in the next transcription, introduced into the text; then again the margin is filled, and again the text is swelled; and so on. They cannot therefore, in the state in which they are now found, be depended on as preserving any resemblance to their original form. Next came into use glosses for whole classes of writers, as for instance, the poetic, the dramatic, the rhetoric, the philosophic, the medical glosses. These also were called γλῶσσαι; afterwards, by a more general denomination, λέξεις; and, when they came to be alphabetically arranged, λέξεις κατὰ στοιχεῖον. The third great step in the approach to a dictionary was made by Diogenianus, a grammarian, placed by Suidas in the second century, who is recorded by Hesychius to have brought together in alphabetic order all the words found in all the preceding collections, whether of the first or second kind, and thus to have formed a compilation from the *Homeric*, the *Comic*, the *Tragic*, the *Lyric*, the *Rhetoric*, the *Medical*, the *Historic* glosses. Suidas, indeed, states this work to have been an epitome of an older one, the joint production of Pamphilus and Zopyrion; but Hesychius, who lived, probably, in the fourth or fifth century,* and certainly much nearer than Suidas to the age of Diogenianus, is more to be relied on.

* Albert, in the preface to his edition of Hesychius—after showing that nothing certain is known as to the age in which this author lived, further than its being subsequent to the times of the several

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The account given by Hesychius is preserved in his dedicatory Epistle to his friend Eulogius, the beginning of which more particularly bears upon this subject, and may be translated as follows: "Hesychius, a grammarian of Alexandria, to his companion Eulogius, greeting.—Many others also collected in the order of the letters the 'words' of the Ancients, O most beloved Eulogius: some, however, those only of Homer, as Apion, and Apollonius, son of Archibius; some, those separately of the Comic, or those of the Tragic authors, as Theon and Didymus, and other such compilers; and no one, all the words of the different writers together. But after these arose a certain Diogenianus, a man of industry and taste, who, having brought together the forementioned books and all the words dispersed through all, united into one compilation in alphabetic order all of them; I mean, the Homeric, and the Comic, and the Tragic terms, and those which occur in the Lyric poets and in the Orators; nor these only, but also such as are to be found in the works of the Physicians and of the Historians. In short, no word, as far as we are aware of, did he omit, whether of the Ancients, or of the writers of his own time."* From the manner in which Hesychius here dis-

grammarians specified by him in his dedication to Eulogius;—concludes with the following observation: "Si quis tamen seculo quarto exeunte, vel paullo post, hoc Lexicon compositum putet, aliis sensim interpolatis; non videtur adeo absurdum sentire."—*Præf.* p. v.

* ΗΣΥΧΙΟΣ ΓΡΑΜΜΑΤΙΚΟΣ ΑΛΕΞΑΝΔΡΕΥΣ,
ΕΥΛΟΓΙΩ ΤΩ ΕΤΑΙΡΩ, ΧΑΙΡΕΙΝ.

Πολλοὶ μὲν καὶ ἄλλοι, τῶν παλαιῶν τὰς κατὰ στοιχεῖον συντεθείκοσι λέξεις, ὦ πάντων ἐμοὶ προσφιλέστατε Εὐλόγιε· ὀλλ' οἱ μὲν, τὰς Ὁμηρικὸς μόνας, ὡς Ἀπίων, καὶ Ἀπολλώνιος ὁ τοῦ Ἀρχιβίου· οἱ δὲ, τὰς Κωμικὰς ἰδίᾳ, καὶ τὰς Τραγικὸς, ὡς Θέων, καὶ Δίδυμος, καὶ ἕτεροι τοιοῦτοι· ὁμοῦ δὲ πάσας τούτων, οὐδεὶς εἷς. Διογενιονὸς δέ τις μετὰ τούτους γεγονὼς, ἀνὴρ σπουδαῖος καὶ φιλόκαλος, τό τε προειρημένο βιβλίο, καὶ πόσας τὰς σποράδην πορὰ πᾶσι κειμένας λέξεις συναγαγὼν, ὁμοῦ πάσας καθ' ἕκοστον στοιχεῖον συντίθεικε· λέγω δὴ τάς τε Ὁμηρικὰς, καὶ Κωμικὰς, καὶ Τραγικὸς, τός τε παρὸ τοῖς Λυρικοῖς, καὶ παρὰ τοῖς Ῥήτορσι κειμένας· οὐ μὴν ὀλλὰ καὶ τὰς παρὰ τοῖς Ἰατροῖς, τάς τε πορὸ τοῖς Ἱστοριογράφοις· συλλήβδην δὲ ὁμοῦ οὐδεμίαν λέξιν, ὥστε ἡμῶς εἰδέναι, παρέλιπε, οὔτε τῶν παλαιῶν, οὔτε τῶν ἐπ' ἐκείνου γεγενημένων. According to the received mode of pointing the commencement of this extract, παλοιῶν is immediately connected with the preceding instead of the following words; by which means Hesychius is made to contradict himself. For if he said, "many others of the ancients also," that is, many others of the ancients as well as Diogenianus, he must have ranked this grammarian among the ancients; whereas he expressly distinguishes him from them at the close of the

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guishes between the Ancients and Diogenianus, it appears that the third kind of compilation did not commence very long before the age in which he lived;* and from his describing the first specimen of it as so complete, it is plain, his own collection could not have been much more comprehensive as to the subjects it embraced. The celebrated work, therefore, of Hesychius, as it came from the hands of this grammarian, must be considered to have been confined, if not to the more difficult and obscure words, at least to those peculiar to the different branches of literature; and not looked on as a general vocabulary of his language. Nor does the present state of the book afford any argument to the contrary; for the MS. copy from which it was printed,—the only one known to be extant,—was written about the year 1400, that is, probably near a thousand years after the time of the author; and how much a work of this kind must have been extended and enlarged in the numerous transcriptions of it which necessarily took place in so long an interval, may be easily conceived. Besides, even so late as the year 1514, when it was first printed, it received considerable additions from Musurus, a native of Crete, to whose care it was committed by Aldus to prepare it for the press; so that its completion must be referred to the sixteenth century, and we are not warranted in ranking it, as it was originally formed, under a more advanced class than that which I have distinguished as the third species of compilation. We have, therefore, still one step higher to ascend before we arrive at a dictionary.

That I might avoid any interruption to the course hitherto pursued in this inquiry, I omitted to mention the Onomasticon of Julius Pollux in the order of its date; because it is not in strictness of the nature of a dictionary, being composed of books, written in the form of separate treatises, which are digested according to subjects, not according to alphabetical arrangement; the words which relate to each subject being brought together, and their differences

extract. I should not have thought this correction worth noticing except to show, that Hesychius does not here supply any ground for supposing that the third stage of the invention in question was ancient in his time.

* This agrees with the account of Suidas, who states that Diogenianus flourished in the reign of the Emperor Adrian; and shows that if another person of the same name was the author of the compilation in question (on which point Suidas expresses some doubt), he still could not have been very distant in time from this one.

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explained. The work, however, from the nature of its formation, has this advantage in reference to the investigation before us, that it did not admit of being enlarged in successive transcriptions in like manner as those previously considered; and, consequently, its original extent may be estimated by its present appearance. As far then as the Onomasticon can be considered as belonging to the class of dictionaries, it affords a safe standard of the progress actually made in the improvement of such books at the time when it was written; and viewed in this light it tends to confirm the representation I have just given of the subject. The work was composed towards the close of the second century; and its exact age is fixed by the circumstance of the first book being dedicated to Commodus before he mounted the Imperial throne. Suidas states that Pollux taught at Athens during the reign of this Emperor; and describes his Onomasticon as a collection of synonymes, written in ten books.*

To return now to the class of works whose contents are alphabetically arranged, and bring our inquiry respecting them to its close;—the oldest collection of the kind upon which any dependance can be placed, that, as transmitted to us, it does not greatly differ from the actual production of the author whose name it bears, is that made by Photius, Patriarch of Constantinople in the latter part of the ninth century, and which was entitled by him *λεξέων συναγωγή*. A MS. copy of this in the Library of Trinity College, Cambridge, which is ascertained to have been written about the end of the twelfth century, was transcribed for the press by the late Dr. Porson; and an edition from it has been since printed at the expense of the College. The learned world is much indebted to Cambridge for this publication, which is a very interesting one, as we have thereby obtained a copy of what was probably the first work that had justly a claim to the rank of a dictionary, and at all events have through it arrived at a limit to the antiquity of such works. For, as Photius was by far the most able and learned man of his age, the compilation he formed must be supposed superior in point of plan and extent to any preceding one, not excepting the original work of Hesychius; yet even with the improvements which it may have received

* *Πολυδεύκης . . . . ἐπαίδευσε δὲ ἐν Ἀθήναις ἐπὶ Κομμόδου τοῦ βασιλέως, καὶ ετελεύτησε βιοὺς ἔτη ν' καὶ ἡ· συντάξας βιβλία ταῦτα· Ὀνομαστικὸν, ἐν βιβλίοις δέκα· ἔστι δὲ συναγωγὴ τῶν διαφόρως κατὰ τοῦ αὐτοῦ λεγομένων·—*

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in the 300 years between its date and that of the MS. in question, it is barely entitled to the denomination of a Lexicon; and if it was at first much inferior to what we at present find it, then dictionaries properly so called cannot be said to have been produced till after the time of its distinguished compiler. The very names now given to works of the kind were unknown to the ancients. *Glossarium* first appears in the writings of Aulus Gellius; but from the context of the passage where it occurs, it cannot be inferred to have been used by him to denote "a book of glosses," nor probably did it acquire that signification till some centuries after. *Lexicon* is, I believe, found for the first time in the Etymologicon Magnum, a compilation of which the author is unknown, but its age is ascertained not to reach farther back than the tenth century.* *Dictionarium* and *Vocabularium* are terms of still later introduction.

Thus, among the Greeks, who certainly are entitled to the credit of this invention, a gradual progress of it may be traced from small beginnings through several successive stages to its present state of comparative perfection; and before the like credit can be allowed to any other people, a like progress must be shown to have taken place among them. But nothing of the sort is established, or even alleged to have been established for the Hindoos; their first works of this nature are said to have been vocabularies of nouns and vocabularies of verbs, which, when united, may have been as extensive as the Greek compilations in the third stage above described; and at any rate show that a considerable advance must have been made in the knowledge of grammar previously to their formation. That the Brahmans may have had such works nearly as long a time as alphabetic writing, I am quite ready to admit; but this circumstance would only prove that they were the offspring, not of native invention, but of foreign, and consequently, of European instruction. And thus we are conducted to a limit of their

* A limit to the antiquity of the work is got by ascertaining the age of the latest authors therein mentioned. On this subject Fabricius states as follows: "Sylburgius non multo post Photii, patriarchæ, tempora vixisse auctorem Etymologici credidit, sed Chœrobosco etiam junior est, quem constat post Simonem, metaphrastem, hoc est, non ante sæculum decimum scripsisse."—*Bibliotheca Græca a Fabricio*, volumen vi. p. 595.

Sylburgius, in the dedication of his edition of this compilation, acknowledges that he could not find out who the author of it was, in these words: "Auctor qui fuerit nondum cognosci a me potuit."

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age in accordance with that already assigned to the Sanscrit alphabet; for Europeans themselves cannot be said to have arrived at even the rudest notion of a dictionary till that of Hesychius was written; that is, till about the fifth century. In connexion with this subject it may also be here observed, that, if the Hindoo grammars were near as old as is pretended, they must have been composed immediately after the introduction of the Sanscrit writing (they could not sooner); and this consideration alone, independently of the internal evidence they afford to the same effect, would be sufficient to establish their European origin.

In the second place, the actual ingredients, as well as the grammatical subtilty of the Sanscrit language, make very decisively against its imagined antiquity. That German, Greek, and Latin enter into the composition of this language, and contribute, not merely to its materials, but even, if I may so express myself, to the very frame-work of its construction, is now so generally admitted, that there is no occasion for my detaining the reader with any illustration of the point,* and I shall, therefore, proceed at once to show how incompatible with this acknowledged property of it are the received notions as to its prodigious age. In order to bear out such age, it is necessary to imagine the Indian tongue to be in a certain degree the parent stock of the European ones just mentioned; and, consequently, to suppose that, at some very remote period, a large body of the Indians advanced to the cold and barren plains of the Scythians,† and thence cut

* I here refer with pleasure to a brief, but very able and interesting treatise on the above subject, by Dr. Prichard of Bristol, which forms a supplement to his *Researches into the Physical History of Mankind*. The author, by introducing the Celtic dialects into the field of this investigation (in which part of his plan he has been lately followed by M. Adolphe Pictet, in a work which has received the approbation of the French Academy of Inscriptions and Belles-Lettres) has thrown great additional light upon the matter, and has clearly established the connexion between nearly all the more ancient North-European languages and the Sanscrit; I differ from him only as to the cause of that connexion.

† To place this theory in the point of view that is least objectionable, I have described the Indians as proceeding first to the north and then to the west; in order to avoid the supposition of their crossing the sea in times when it is utterly improbable that there was shipping, upon a great scale, in any part of the world. Yet a very distinguished supporter of the theory in question does not shrink from adding even this to the other improbabilities of the case. Baron Cuvier, in reference to the Greek portion of the Sanscrit language, writes thus: "The Pelasgi were originally from India, of which the Sanscrit roots that occur abundantly in their language do not permit us to doubt. It is probable that by crossing the mountains of Persia they penetrated as far as the Caucasus; and that

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their way into the forests of Germany;—without any conceivable motive for their adopting such a course, and without either the courage or the energy that must have been requisite for putting it into execution. Surely the bare statement of this hypothesis is sufficient to expose its monstrous improbability; the Ganges might almost as easily be conceived to have in days of old flowed backward to water the wilds of Siberia. Oh no! The larger currents of human emigration have never taken such a direction as that here fancied;* it has always been, on the contrary, the hardy sons of the north who, in search of more genial climes and more fertile soils, have made incursions towards the south; and the admixture of German with the languages of Persia and India, can be accounted for only by the supposition of numerous hordes of Germans having formerly made good their settlement in those countries.

The correctness of this view of the subject history supports, not only by recording analogous cases of emigration, but still farther by supplying us,—there is some reason to think,—even with the very identical instance which occasioned

from this point, instead of continuing their route by land, they embarked on the Black Sea, and made a descent upon the coasts of Greece."—*Baron Cuvier's Lectures on the Natural Sciences.* With respect to the *probability* here stated, there are two points which I beg to submit to the reader's consideration. Supposing a body of five or six hundred thousand Indians, with their wives and children, were now to force their way to the eastern shores of the Black Sea: 1°. is there in the entire of that sea, even at the present day, shipping sufficient to convey such a multitude on the voyage pointed out by the Baron? 2°. even granting the shipping there to be sufficient for the purpose in question, is it ever collected, the whole of it together, on the eastern shore, or if it were, would the Indians, in the imagined case, be able to prevent the dispersion and escape of by far its greater part?

* The strangeness of the hypothesis under consideration reminds one of Seneca's fanciful prediction, that Indians should settle on the banks of the Arras or the Wolga; and Persians on the Elbe and the Rhine.

"Indus gelidum potat Araxem;
Albim Persæ, Rhenumque bibunt."

Senecæ Medea, Act. ii, vv. 373-4.

How very different in its bearing upon the same point is the prophecy of Noah! In this prophecy—the oldest but one in the Bible, and which history, as far back as it reaches, remarkably verifies,—it is foretold, not that Asiatic nations should settle in Europe, but on the contrary, that Europeans should establish their residence in Asia. "God shall enlarge Japheth, and he shall dwell in the tents of Shem."—Gen. ix. 27.

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the phenomenon under consideration. Before I come to this instance, I shall notice but one subordinate case. The Galatians, to whom St. Paul addressed one of his Epistles, were confessedly the descendants of Gauls who had forced a passage into Greece and thence into Asia; and, above six hundred years after, in the time of Hieronymus, their posterity, according to this divine, spoke nearly as good German as the inhabitants of the city of Treves;—a circumstance which he puts very prominently forward in the exordium to his commentary on the Epistle just alluded to.* But a far more extensive irruption of Northerns into Asia, and earlier by about four hundred years, is upon record; the account given of which by Herodotus, in different parts of his celebrated work,† is so well known that I consider it unnecessary to quote what he has stated upon the subject, and shall confine myself to the following abstract of his narrative. The Cimmerians, who were a European people, flying from the Scythians, and, somehow or other, getting out of the way of their pursuers, took a westerly direction, and seized on the territories of the king of Lydia, which at that time extended over nearly the whole of Asia Minor. The Scythians, on the other hand, swept like a torrent over the countries that were more to the east, and pushed their conquests towards the south as far as the confines of Egypt, from entering which kingdom they were prevented only by large presents from Psammetichus. After they had kept possession for twenty-eight years of what the historian calls Asia, they were, by far the greatest number of them, destroyed in Media by means of a treacherous stratagem, in the time of Cyaxares, great grandfather of Cyrus; and the Cimmerians probably held Lydia about as long, since they were thence driven by a prince who was the cotemporary of Cyaxares. Of the Scythians who escaped from the general massacre of their tribe by the Medes, some fled to Lydia, where they were hospitably received, and others returned to their native country; but with respect to the Cimmerians, we are not told what became of them after their expulsion from Lydia. As, however, it is not stated that these latter barbarians were much reduced in force, there is no reason whatever for

* Unum est quod inferimus et promissum in exordio reddimus, Galatas, excepto sermone Græco quo omnis Oriens loquitur, propriam linguam eandem penè habere quam Treviros.—*S. Hieronymi Operum*, tom. iv, p. 256.

† See, in this work, Book i, chapters 15, 16, 72, 74, 103, 104, 105, 106, and Book iv, chapters 1, 3, 4.

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supposing that they bent their steps back towards the dreary north; while on the other hand, the traces of a North-European language found in India render it likely that they may have invaded and conquered part of that widely extended country. But whether it be to them or to some earlier horde of intruders that those traces are to be attributed, the lingual phenomenon in question renders it certain that, at some very remote period, a large colony of people speaking a dialect of close affinity to the German tongue, settled in Hindoostan; and the analogies of history show very clearly how the event may have occurred.

Two very grave objections which beset the opinion hitherto most generally received, having been removed by the mode now proposed of considering the subject, it remains to be inquired, in the third place, whether the rest of our way to a consistent account of the origin of the Sanscrit language can be cleared of difficulties. The cause of the infusion of German into this language has been just ascertained: but the admixture with it of Greek and Latin cannot be explained in the same manner, as no extensive settlement of either Greeks or Romans was ever established in India. Some other source must, therefore, be sought for the South-European part of the compound in question; and here the old connexion which has been already proved to have subsisted between the Egyptians and Indians, naturally presents itself. One of the most remarkable of the institutions of the former people was that of a sacred dialect, the principle of the formation of which (as, from the scanty remains of it preserved by Josephus, has, I trust, been made apparent in the part of my work already published) was the agreeing upon meanings for Egyptian words quite different from their common or ordinary acceptations; whereby the priests were enabled, as long as they kept their secret, to converse among themselves in a species of gibberish that was to the people at large an unknown tongue. Now why may not the Brahmans of early times have taken a lesson from their Egyptian instructors in this, as well as they certainly did in other respects? The introduction, indeed, into their sacred language of South-European ingredients was a mode of rendering it unintelligible to the vulgar, which was a great improvement on the model they had to follow; but the end of the formation of both dialects appears to have been just the same. And in like manner, as I conceive, it was the desire of having a species of writing which the Indian public could not read,—till they were specially taught its nature, and which most probably for ages they were not

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taught;—that induced their priesthood to imitate a foreign plan in the construction of a graphic system wholly different from that to which, as hieroglyphists, they had been previously accustomed.

But in reference to the subject of investigation more immediately before us, we have to notice the great spread of Hindooism among the indolent and voluptuous inhabitants of Southern Asia,—a circumstance which can be easily accounted for. However Brahmanism, the form which this religion assumes within India, and Boodhism, that which it takes outside, may otherwise differ, they agree in a principle most conducive to their general diffusion. Their supreme deity is the god of Epicurus of old, and the notion of him was most probably derived from the Epicurean philosophy; his beatitude consists in "that he do nothing, understand nothing, desire nothing;"* so that in the conception of his worshippers he is, with respect to the moral government of the world, an absolute non-entity. By believing in such a god it is evident, that the warnings of conscience are drowned, and all restraint upon the passions is removed. The consequence unfortunately is, that Hindooism, in one or other of its forms, at present includes among its votaries nearly half the entire number of the beings who compose the human race. But as far as ever this pernicious superstition has reached, it is through the medium of the Sanscrit language that its doctrines have been conveyed. It is, therefore, no way inconsistent with my view of this language having originated in the contrivance of but one particular caste, that it should become so widely diffused, as it eventually has been, among the nations of the earth; for the use to which it has been applied, suggests an adequate cause for the vast extent of the field over which it has spread.

But as the circumstance which has been just considered, does not bear against the assigned origin of the Sanscrit tongue, so there are others which, I apprehend, tell very strongly in its favor. Wherever this tongue is at present made use of, it is employed only as the language of religion and learning; and no country can be pointed out where it can be shown, even with the remotest degree of probability, that it ever was spoken by the nation at large. What, however, I principally rely on is, the internal evidence which the language itself supplies upon the point in question. Here a general consideration first presents itself, with which,

* See Dr. Marshman's *Clavis Sinica*, page 165.

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I apprehend, the inquiring mind must be struck; namely, that, notwithstanding the number and complication of the rules of the Sanscrit grammar, there are, it is said, no deviations from them. Now this is a peculiarity which never took place in any national language; even Latin, which is perhaps the most regular of all, occasionally presents to us, in the writings of the very best Roman authors, expressions which are not strictly reducible to any rule; and the necessity for the occurrence of this irregularity in every dialect spoken by the whole population of a country is obvious. Illiterate persons are continually introducing incorrect phrases, which are at first avoided by the learned; but as soon as ever one of those phrases is adopted by the great majority of the people, it then, in a manner, forces itself upon men of better education. Alphabetic writing, indeed, checks this evil, but it cannot completely stop it; and the consequence is, that there never was a national language, without its idioms. It was the assertion of grammarians, that the Sanscrit tongue was free from all irregularities, which first turned my attention to the extreme unlikelihood of its having ever been used generally by an entire nation; and more particular consideration of its grammar has confirmed me in this view of the subject.

In the first place then,—to proceed to particulars,—the letters of the Sanscrit alphabet are arranged according to the organs by which they are uttered. This is an arrangement that has been made by grammarians in the case of many alphabets, but it never has been adopted by the nations using them. The order in which the letters of each national system are placed, has been determined by imitation of some older one, or by accidental circumstances; and when once fixed, people who have learned them in this order, will not submit to the trouble of changing it. The artificial arrangement, therefore, of the Sanscrit letters clearly distinguishes the system to which they belong from all that have commenced in national use; and marks out that it was originally formed not for the bulk of a people, but for and by a particular class of persons who had already made a considerable progress in the technicalities of the grammatic art.

In the second place, there is a metaphysical refinement in the grammar of this tongue, which never could have originated in national practice. If the Sanscrit words be distinguished into sets of a common general meaning and a common original, most of those sets have, each of them, a धातु DHāTŭ or root, which expresses a general idea abstracted from every modification of it that cor-

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responds to any inflexion, and so is a significant term at the same time that it does not belong to any grammatic part of speech ;*—a description which in some degree involves a contradiction; for if an articulate sound be significant it is a word, but it cannot be a word without coming under the head of some part or other of speech. Now, I maintain it, this is a mere artificial contrivance, and not a natural production of the human understanding. In fact, mankind, considered at large, would never go to the trouble of framing words of which yet they were not to make any use in mutual intercourse. The Sanscrit grammarians call these *dhātŭs* by a term which signifies *nature;* but surely no appellation was ever more misplaced; such monstrosities must have sprung, not from the plain, natural sense of unsophisticated minds, but from the fanciful conceit and perverted ingenuity of wrong-headed metaphysicians. In languages destitute of inflexions, like the Chinese, there are words which may in turn serve the office of every part of speech according to their position in sentences; but this is a very different thing from their belonging to no part of speech. In those which are distinguished by inflexions, it is generally the simplest form of a word that is looked upon as the root; and if the language be only partly inflected, this root may be common to more parts of speech than one. Thus in English the root of the words lov*est*, lov*eth*, lov*ed*, lov*ing*, lov*ely*, is love, which may be either a noun or a verb; but this again is a very different case from its being neither the one nor the other, and yet signifying the abstract thought of love. If we take an example of a set of words of the same general meaning, in any of the more completely inflected languages, as for instance in Latin; amo is usually considered as the simplest form of the verb expressive of love, and, consequently, as the root of all the other forms of it; but this root agrees not with the notion of a *dhātŭ*, for not only does it belong to a particular part of speech, but also it includes a particular inflexion of that part. If on the other hand we confine ourselves to the syllable AM, which is common to all the modifications of the word in question, we in one respect approach nearer to our Indian model, in that we have got an articulate sound that is not in Latin either a noun or a verb, or any other part of

* In reference to the Sanscrit roots of verbs, Mr. Carey informs us, that "The meaning affixed to the *dhātus* is designed to express merely the simple idea, they being in their crude state neither nouns nor verbs."—*Carey's Gram.* p. 137.

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speech; but in that language it has no meaning, and, consequently, still fails to supply us with a *dhātŭ;* as soon as ever we amplify it sufficiently to have a meaning, it is immediately restricted to some particular part of speech, and to some particular form of that part. In short, as far as I am aware of, there is no language, unconnected with the Sanscrit, in which there is to be found a set of words of the same kind as the Indian *dhātŭs;* and whoever impartially considers the matter, must, if I mistake not, perceive, that these creatures of the imagination, or, as it were, metaphysico-grammatic pegs for hanging words upon, never could have had their rise in the practice of any nation; and that their production is attributable solely to some class of individuals who had far more leisure and and less common sense than fall to the share of the great body of mankind.

In the third place, the total transformations which the roots of words occasionally undergo in Sanscrit sentences, manifestly show design on the part of those who introduced them;—design which is incompatible with the supposition of their having originated in a natural way. In all natural changes of language by which new dialects are produced, the newly adopted modifications of words have arisen from causes independent of human forethought, and are to be ascribed to the influence of external circumstances operating on the organs of speech, the sense of hearing, and the instinctive energies of man, rather than on his intellect or will. This, I apprehend, may be fairly inferred from the savage character of those by whom such changes are brought about, and from the consideration that a great alteration in the grammatical frame-work of a language has never been suddenly effected in a civilized state of society. Thus the transition from Latin to Italian is due to savages who took no interest in philological speculations, but were wholly intent upon fighting and plunder; as soon as they became a little civilized, and capable of reflexion, an end was put to all further violent innovation in the structure of their speech.* But however devoid of

* The power which alphabetic writing exerts in preserving the grammatic structure of a language is strikingly illustrated by the above example. What space of time was occupied in completing the transition from Latin to Italian cannot now be exactly ascertained; but it undoubtedly was very short in comparison with the previous duration of the older dialect, or the age which the subsequent one has since attained to. The savages who effected this transition could neither read nor write (and if the nation they conquered had sunk into equal ignorance, the difference between the ancient

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attention or design men may be in the case of the natural production of new verbal modifications, yet in general those modifications are in the same dialect similarly made for similar alterations of the sense; partly from the instinctive predilection of the mind for uniformity, and partly perhaps from some indistinct reference to older forms. It is this analogy in their formation that, afterwards presenting itself to notice, gives room for the application to them of grammatic rules of classification, determining how each word is to be inflected for the several varieties of its primary signification, in polysyllabic tongues; or how its elementary sounds are to be changed in composition or in connexion with other words of a sentence, in the languages which admit of such permutations. In all those modifications of a word, when arising from a natural source, one common property is observable; namely, that the root is scarcely ever wholly changed; for it is impossible that the expression for the principal part of the meaning of a term should entirely disappear without arresting the attention of the person who introduced so striking a transformation. Hence the instances of total alterations of the kind in the construction of sentences are few and anomalous in, I believe, every known language except the Sanscrit; while in this latter tongue the *dhātŭ*

and the modern language of Italy would probably have been much greater than it now is); but as soon as the art in question again came into use among the upper classes of society, all great changes of Italian ceased; it has, indeed, since received gradually improvements, but its grammatic frame is, in the main, unaltered from what it was at the earliest period to which it can be traced. On the other hand, however barbarous in other respects were the Turkish invaders of Greece, they still had an alphabetic writing of their own distinct from that of the Greeks; which circumstance effectually prevented any blending of the languages of the two people. The consequence is, that Greek never underwent a total change in its inflexions; and it is not perhaps too much to say, that the modern language scarcely differs from the dialects which were spoken in Greece three thousand years ago, more than those dialects differed from each other. Compare now with those two examples the case of South-Eastern Asia and of America. In the former district,—where alphabetic writing is probably not of very ancient standing, and where its use has been considerably deteriorated by the predominance of hieroglyphic practice,—great numbers of languages have started up, many of them even since the formation of the Sanscrit, from which they obviously are in part derived. In the latter range of countries,—into which it is certain that the alphabetic art was not introduced till the time of the Spanish invasion, and which the state of their population affords reason to think, were not then very long peopled,—there have been found no less, it is said, than *fifteen hundred* different dialects spoken by the original inhabitants.—See *Pritchard's Supplement*, &c. p. 11.

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not unfrequently disappearing,* does so, exactly according to rules which, for every case, determine the substitutions that are to be made; and that in so precise and definite a manner, that the student can always recover the root;—a circumstance which, as I conceive, strongly marks out a considerable part of the Sanscrit structure as artificial, and draws a broad line of distinction between it and all natural languages.

In the fourth place, "to be" is expressed in Sanscrit by two different verbs, which in the first person singular are, अस्मि ASMI, from the *dhātŭ* अस् AS, and भवामि BHăVā MI, from the *dhātŭ* भू BHū; but of these the latter is conjugated through all the moods and tenses of the active, passive, and middle voice;—a peculiarity of which, I believe, no instance is to be found in any natural language. In fact the verb substantive, though in many languages used as an auxiliary in the expression of passive forms of thought, does not, when employed as a principal, in strictness admit of the distinction of voices, and in consequence is generally confined to the inflexions of a single voice. There are, however, several exceptions to this restriction; in Hebrew, for example, the verb היה, HaYaH, is found in a few of the passive inflexions of the preterite and the participle *benoni;* in Greek, εἰμί is used in the imperfect and first future middle; and in Welsh, BÔD occurs in the third person singular of the tenses of the passive voice.† Many other such instances might be adduced; and it is only accordant

* Mr. Carey enumerates the following ways of forming derivatives from *dhātŭs:* "1. by prefixing an inseparable preposition; 2. by inserting a syllable or syllables between the root and the other additions; 3. *by a substitution of other letters for some or all the original letters of the* dhātŭ; 4. by affixes; 5. by the terminations which make the inflexions of nouns and verbs.—*Carey's Gram.* pp. 11-12.

† See Dr. Pritchard's *Supplement*, &c. p. 174. I take this opportunity of noticing an observation of Dr. Pritchard's respecting the Welsh language, which in a philological point of view is very valuable. By a comparison of the personal inflexions of the verbs with the pronominal suffixes to other words, he has proved those inflexions to consist of fragments of pronouns, in like manner as in Hebrew; or, to give his conclusion on the subject in his own way of expressing it, he has clearly shown, "that the Welsh verbal terminations are in general merely abbreviated or modified pronouns, affixed to the verbal roots; and this conclusion does not rest merely upon a probable conjecture, on which the grammarians of other Indo-European languages have been obliged to found it, but on the more substantial fact, that the very terminations in question are actually to be identified with the

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with what was to be expected from the nature of the case, that great irregularities should occur in a verb which, in all languages, must have been one of the first inflected, and in most of them probably was brought into use before their models for uniformity of inflexion had been established. But that the common sense of mankind is opposed to the employment of this verb in more voices than one, is proved by the circumstance, that, although they would not give up irregular inflexions of it to which they had been once habituated, they yet never completed those inflexions throughout the moods and tenses of a second voice. The very striking difference in this respect between the Sanscrit and all other languages,

pronouns, as they are used on other occasions in an abbreviated form."—*Pritchard's Supplement*, &c. p. 133. But the structure of the formative additions to the root of the verb is more clearly discernible in Hebrew than in Welsh combinations, in this respect, that, in the former language, the case of the pronoun of which part is employed, can be frequently distinguished; and then, in accordance with strict correctness of expression, it is found to enter the formative in the nominative case, while on the other hand, the modification of it appropriated to obliquo cases, is that which is used as an affix. Thus *pakad-ta* (thou hast visited) has the termination of the pronoun of the second person singular masculine in the nominative case; but *pekod-ka* (thy visiting, or to visit thee) and *pekad-nu-ka* (we have visited thee) exhibit, each of them in its last syllable, the termination which belongs to this pronoun in obliquo cases. Still, however, there is a far greater distinctness of the elements of inflexion in Welsh than in any of the other ancient European tongues; whence it would appear, that the progress of amalgamation which takes place after the formation of a new dialect, lasted a shorter time, and by the use of alphabetic writing—the only conceivable means of producing such an effect,—was sooner stopped in this tongue than in the rest; and, consequently, that it has been transmitted to us in an older state than any other of the North-European languages which have sprung up from the same stock. This inference from the structure of the Welsh dialect is, to some extent, supported by historic evidence; for the ancient Britons, from their close connexion with the Romans, early got the benefit of alphabetic writing, and were comparatively civilized at the period when their Saxon oppressors were in a state of the grossest barbarism. Hence it is probable that Welsh is older than any form of the German language now extant; though it falls short of the age of Latin by near a thousand years, and of that of Greek by a still greater interval. The claims, therefore, which the Germans set up for the antiquity of their language are wholly inadmissible; indeed one can hardly avoid smiling at the extravagance of those claims. Thus one of their writers, Jäkel, in a work published so lately as the year 1830, under the title "Der germanische Ursprung der lateinischen Sprache," has seriously endeavoured to prove that Latin was derived from German. He might just as rationally have attempted to prove that the Roman alphabet was derived from the German one; or rather, indeed, he should have commenced with this latter notable point, and have shown the German graphic system to be the older of the two; for nothing can now be known of the language of any people before the epoch of their first use of letters.

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has strangely been laid hold of as a mark of its great antiquity; but leads, as I conceive, to quite another result, and chiefly serves to show its artificial origin.

It is unnecessary to go farther into particulars under this head; many others probably will occur to the Sanscrit scholar, bearing the same way; but a sufficient number, I apprehend, has already been adduced to establish, beyond all doubt, the fact that the language in question owes the original production of a great part of its structure, not to causes naturally operating on the human mind, but altogether to artificial contrivance. Now what conceivable motive, except that which I have suggested, could have influenced men to take the trouble of artificially framing this most troublesome and complicated in its frame-work of all languages? Upon the whole, then, there are three properties of the Sanscrit tongue to which I have endeavoured chiefly to direct attention; 1. the subtilty of its grammar; 2. the infusion into it of Greek and Latin as well as of German; 3. its artificial formation. But with those properties the view which I have submitted to the reader is not merely compatible upon general principles, but its congruity with them is sustained and borne out by the historic evidence of analogous cases; while on the other hand, the opinion which has hitherto prevailed on the subject is wholly irreconcileable with every one of the three.

The statement which I wish to place before the Royal Irish Academy respecting the nature, age, and origin of the Sanscrit, both writing and language, is now concluded, as far as it depends on the immediate investigation of the subject in question. But as considerations drawn from astronomical science lend a great accession of strength to my argument,—not only in showing that the authority of the Brahmans, which is entirely opposed to my representation, is entitled to no sort of attention, but also in other ways;—I think it right to avail myself briefly of the collateral support which I can thence derive; for which purpose I shall chiefly refer to two articles of J. Bentley, Esq., inserted in the sixth and eighth volumes of the *Asiatic Researches*. These articles are well worth reading on their own account, and afford a happy illustration of the force with which mathematical skill may be sometimes brought to bear upon subjects that are not purely of a scientific nature; but my description of them, confined as it must be within narrow limits, and destitute of the explanatory aid which examples of calculations actually worked supply, will, I fear, convey but a very

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inadequate idea of the great clearness and ability with which they have been composed.

The main foundation of Mr. Bentley's discovery respecting the Hindoo astronomy, and which he has established in the most convincing manner, is, that every known system of it, excepting, indeed, those grounded upon methods obviously borrowed from modern European science, is constructed on the following principle. The framer of each system selected *ad libitum* as the epoch from which the celestial motions were to be calculated, some very remote point of time, with no other restriction than that, according to his notion of the length of a year, the sun must have been then exactly in the vernal equinox; and arbitrarily assumed that, at that very instant, the moon and planets, with the nodes and apsides of their orbits, were in conjunction with the sun (that is, that as seen from the earth they were then in the imaginary right line passing through the centres of the earth and sun). Such a coincidence most probably never occurred, and certainly did not occur, as Mr. Bentley has clearly shown, at the commencement of the *Cali yuga* of the system of *Veraha*, (in the year B. C. 3102), to which instant of time it is ascribed, as well as to the epoch from which the system is made to begin.* In this, as well as in the other purely Hindoo systems, the number of revolutions performed by each celestial object during the *Calpa*, or grand cycle, is fixed; consequently the mean motion of each is determined; and the calculation of its mean heliocentric longitude at any assigned time is greatly simplified by the above described assumption. For as the whole length of the Calpa is to the part of it elapsed up to any assigned instant, so is the number of revolutions performed by any planet in the former space of time to the number performed by it in the latter space; from which, deducting the integers, the fractional remainder gives, according to the assumption in question, the sought longitude. It is, however, certain that every such system being founded on a

* To express myself more accurately, an *actual* conjunction is assumed to have taken place only at the commencement of the great cycle (or *Calpa*) of this system; and a *mean* conjunction at the commencement of its *Cali yuga*. What the actual positions of the heavenly bodies at the remoter point of time were (supposing them to have been then in existence), it would be impossible now to ascertain; but their positions at the nearer epoch, calculated according to their mean motions, are easily determined, and come out altogether different from what they should be, to verify the Hindoo assumption respecting them.

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false hypothesis, must exhibit the mean motions too great for the planets which had really passed the line of conjunction at the assumed epoch; and too little, for those which then had not as yet arrived at it. The remoter, indeed, that epoch is, the less will come out the error in the mean motion of each planet, as being a given quantity (and that, at all events, not more than a semicircle) distributed among a greater number of revolutions; which explains the cause of the Hindoo cycles being made so enormously great, and of their magnitude being increased in each succeeding system. By such means the errors in mean motion may be so much reduced, that the mean longitude of each of the heavenly bodies,—which can be determined by the system, at a certain period not very far from the time of its being constructed, just as accurately as by European tables,—shall come out nearly accurate for some length of time reckoned backward and forward from that period; the interval during which the system thus answers being greater, in the same proportion, as the errors in the mean motions it exhibits, are less. But after some years the accumulation of errors, be they ever so small, must at last become sensible; and the farther the time for which the mean longitudes are sought, recedes from the era of the construction of any set of Hindoo tables, the greater must be the errors of the several computations in which those tables are employed; a circumstance which has given occasion to successive formations of different systems, or rather to reconstructions of the one system, the main principle on which they all are founded being the same.

If a set of tables were framed ever so correctly upon the plan I have just sketched out, they still could give the mean place of each heavenly body with exactness only at one instant; but they would so give it for every planet, apsis, and node, at the same point of time, namely, at the time of their being constructed. As however the case is, no Indian tables are so correct; in all of them the moment of exactness is different for different celestial objects; but for each object this moment can be ascertained in any set by a simple proportion. For the error in the present mean longitude of a celestial object as given by a Hindoo system, is the accumulation of error in mean motion since the instant for which we are searching; but the quantity of the former error is got by calculating the present mean place of that object according to the Hindoo tables, and also according to correct European ones, and then taking the difference; and in like manner the quantity of the latter error is had by calculating in each set of tables

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the motion of the same object in a hundred years, and taking the difference. As, then, the error of motion for a hundred years is to the present error of mean longitude, so let one hundred years be to a fourth proportional; and this will be the number of years that have elapsed since the point of time when the system gave with exactness the mean longitude of the celestial object under examination. Now it is evident that the aim of an Indian astronomer, in constructing new Hindoo tables, must have been to avoid the inaccuracy, ascertained by experience, of older ones, and to make his calculations as to the places of the heavenly bodies agree with actual observation as near as he possibly could. But in adjusting the mean motion ascribed to each planet so as to accomplish this end, he was in fact bringing the above-mentioned point of exactness (if I may so call it) near to his own time; and the more successful he was in his adjustment, the nearer those two points of time must have been to coincidence. We cannot, however, depend upon any single operation for determining the latter time by means of the former. It is far more likely, considering the imperfection of the Hindoo's means, that in every case there should be a failure of coincidence, the point of exactness for some of the planets, &c. preceding the era of the construction of his tables, and for others following it. The only secure way, therefore, of arriving at the era in question is to calculate several of those points, and the greater the number of the calculations, the nearer must their mean result come to the precise epoch which is the object of our search.

The method above described has been applied by Mr. Bentley to determining the ages of the two principal Hindoo systems of astronomy, that of *Varaha Mihira*, which is detailed in the *Surya Siddhanta*, and is asserted by the Brahmans to have been constructed above two millions of years ago; and that of *Brahma Gupta*, which is acknowledged on all hands not to be above thirteen hundred years old. Let us begin with the former system. In the year 1799, when Mr. Bentley made his calculations, the error in the mean longitude of the Moon's apogee, as deduced from the tables of the Surya Siddhanta, was $4^\circ\ 15'\ 28.2''$; and the error of those tables as to the motion of the same apsis in the course of 100 years is $42'\ 10.9''$. As then $42'\ 10.9''$ is to $4^\circ\ 15'\ 28.2''$, so let 100 be to a fourth proportional, which comes out 605. There had, consequently, in the year 1799, about 605 years passed, since the time when the tables of the *Surya Siddhanta* would have given the mean longitude of the Moon's

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apogee correctly, which could not be distant by any great interval from the time when those tables were constructed. By similar calculations applied to the Moon's ascending node, the Sun's apogee, Venus, Mars, the Moon, Jupiter, Saturn, Mars's aphelion, he got for each calculation a number of years which could not be very different from the age of the Surya Siddhanta; and the mean result of the ten operations gave that age, at the time of their being made, somewhat less than 731 years.

From the foregoing result, combined with other considerations, Mr. Bentley very justly drew the following conclusion. "Therefore, any Hindu work in which the name of Varaha or his system is mentioned, must evidently be modern; and this circumstance alone totally destroys the pretended antiquity of many of the *Puranas* and other books, which, through the artifices of the Brahmanical tribe, have been hitherto deemed the most ancient in existence."—*Asiatic Researches*, vol. vi, p. 574. To this it was objected by a cotemporary writer, that the Varaha who wrote the astronomical treatise was a different person from Varaha Mihira;—an objection which has no ground whatever to rest on except the assertion of the very persons whose veracity is called in question, and to which, besides, our author gave the following answer. "It was not necessary that the name of Varaha Mihira should occur in the Puranas to prove them modern; for, putting Varaha and his system altogether out of the question, yet still the names, not only of the princes in whose reigns he lived, but also of several others, down to the last Mohammedan conquest, with the years of each reign, are to be found in some of the Puranas; a most certain proof that these works are not the genuine monuments of primeval times."—*Asiat. Resear.* vol. viii, p. 201. To this reply of Mr. Bentley I must add, that he has, by his astronomical proof, completely identified the age of Varaha, the author of the system in question, with that of Varaha Mihira, which falls inside the limits within which Indian chronological dates can be securely depended on; or in other words, he has proved that the Varaha who wrote the Surya Siddhanta lived at a time when it is known to a certainty, from historic records, that a person of that name lived; so that here, in some degree, history lends her aid, in verification of the result to which science had by a different route conducted us.

But a far more decisive and convincing proof of the correctness of Mr. Bentley's method is supplied by the method itself; as may be perceived from his

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second application of it, to a brief account of which I now proceed. Brahma Gupta flourished about the year of our era 527; a date, respecting which there is no disagreement, and which is sufficiently verified by the position of the colures on the Hindoo sphere, as fixed by him. Now the English astronomer deduced the time in which the tables of Brahma Gupta were constructed from nine different operations; by calculating, in the manner already described, the several lengths of time elapsed since those tables would have given exactly the mean longitudes of the Moon, Mercury, Venus, Mars, Jupiter, Saturn, the Moon's apogee, her ascending node, the Sun's apogee; and by taking the ninth part of the sum of those lengths. The mean result was found to be $1263\frac{2}{3}$ years; and if these be deducted from 1799, the year when the calculations were made, the era of the construction of the tables comes out A. D. $535\frac{1}{3}$, or eight years four months different from that era, as otherwise ascertained. But in a system framed somewhere about six hundred years after, it is probable that the mean motions of the heavenly bodies are given more accurately in accordance with the artificial basis of Hindoo astronomy than in that of Brahma Gupta; whence it may, as I conceive, be fairly inferred, that the age which has been made out for the Surya Siddhanta differs from the truth by less than eight years.

In confirmation of our author's account of the false assumption on which the Indian astronomy is founded, I give the following extract from Mr. Harte's translation of Laplace's *Systême du Monde*. "The Indian tables indicate a knowledge of astronomy considerably advanced, but every thing shows that it is not of an extremely remote antiquity. And here, with regret, I differ in opinion from a learned and illustrious astronomer, whose fate is a terrible proof of the inconstancy of popular favour, who, after having honoured his career by labours useful both to science and humanity, perished a victim to the most sanguinary tyranny, opposing the calmness and dignity of virtue, to the revilings of an infatuated people, of whom he had been once the idol. The Indian tables have two principal epochs, which go back, one to the year 3102, the other to the year 1491, before our æra. These epochs are connected with the mean motions of the Sun, Moon, and planets, in such a manner that, setting out from the position which the Indian tables assign to all the stars at this second epoch, and reascending to the first by means of these tables, the general conjunction which they suppose at this primitive epoch, is found. Baillie, the celebrated astronomer

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already alluded to, endeavours, in his Indian astronomy, to prove that the first of these epochs is founded on observation. Notwithstanding all the arguments are brought forward, with that perspicuity he so well knew how to bestow on subjects the most abstract, I am still of opinion, that *this period was invented for the purpose of giving a common origin to all the motions of the heavenly bodies in the zodiac.* Our last astronomical tables being rendered more perfect by the comparison of theory with a great number of observations, do not permit us to admit the conjunction supposed in the Indian tables;"—*Harte's Translation and Commentary*, &c. vol. ii, pp. 220-1.

From the above extract it appears that Laplace was aware of the artificial nature of the Hindoo systems of astronomy, as well as of the falsehood of the claims to antiquity which are set up for them by the Brahmans. But the beautifully ingenious application of the knowledge of that nature to the purpose of compelling each system to tell its own age, is, I believe, altogether and exclusively Mr. Bentley's invention. I subjoin another extract from the same translation of Laplace's work, which affords some additional proofs of the several sets of Indian tables having been constructed in comparatively modern times. "Many elements, such as the equations of the centre of Jupiter and Mars, are very different in the Indian tables from what they must have been at their first epoch. A consideration of all these tables, and particularly the impossibility of the conjunction at the epoch they suppose, prove, on the contrary, that they have been constructed, or at least rectified, in modern times. This also may be inferred from the mean motions which they assign to the Moon, with respect to its perigee, its nodes, and the Sun, which being more rapid than according to Ptolemy, indicate that they are posterior to this astronomer, for we know, by the theory of universal gravitation, that these three motions have accelerated for a great number of ages. Thus this result of a theory so important for lunar astronomy, throws great light on chronology."—*Harte's Translation*, &c. vol. ii, p. 222.

Although I avail myself of the support afforded by the proofs alluded to in the above extract, both on account of the great—the deservedly great—scientific celebrity of their author, and also because they lead to a right result; yet I am bound to add, that the last of them, and that upon which he appears chiefly to rely as a useful test of chronology, is, in reference to that of India, altogether inconclusive. For the age of a set of Hindoo tables can in no way be deduced

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from the motions they assign to the Moon, unless they exhibit those motions correctly for the time when they were constructed. But from M. Laplace's own showing it follows that they can none of them be, in the remotest degree, depended on as accurate to this effect; since he admits that the Moon was not in the position attributed to her in any Indian system at the epoch from which its computations are made to commence; and has proved that her mean motions, in each system represented as constant, are in reality varied in the course of time. That we may see more distinctly the combined effect of the two misrepresentations, let us first suppose for a moment the motions in question to be constant, as they are exhibited by the Indian astronomers. Then the framer of each system, as reckoning from a wrong beginning, must necessarily have assigned a wrong mean *motion* to the Moon, in order to bring out her mean *place* right at the end of the computed revolutions, that is, in his own time. If on the other hand, we suppose the Moon's position at the commencement of an Indian epoch to be rightly given, then the uniform mean motion attributed to her, could agree with her really varying mean motions only once during the immensely long course of the acceleration of those motions, and once during their retardation. Let now the real state of the case be considered, both sources of incorrect computation being taken into account; and it is possible that an Indian set of tables may, by a compensation of errors, give a right return of the lunar motions twice in the period of the variation of those motions; but the chances are millions to one against either time of their doing so coinciding with the era of their construction. M. Laplace, therefore, was wholly unwarranted in arguing from the motions under consideration, as if they were rightly given just at that era.

An example or two will, perhaps, place this matter in a clearer point of view. M. Laplace states that the Indian tables assign mean motions to the Moon more rapid than according to Ptolemy, and thence infers that they are posterior to the age of that astronomer; but he might have added, that the motions in question are more rapid than according to Lalande, and, consequently, upon his own principle, the tables exhibiting them are more modern than those of Lalande,—a conclusion which is obviously false. Thus for instance, in the tables of Brahma Gupta, the mean motion of the Moon is exhibited more rapid than in those of Lalande by $5'\ 38.9''$ in a century;* and, therefore, according to our author,

* See *Asiatic Researches*, vol. vi, p. 580.

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Brahma Gupta is more modern than Lalande;—indeed so much more modern, that the time of his existence is not yet arrived, nor will it for near four thousand years to come;* and it must have been only by some sort of prophetic anticipation that the Brahmans have had his tables for the last 1300 years. Again the same tables exhibit the mean motion of the Moon's apogee slower than in those of Lalande at the rate of 8′ 3.4″ in a century; which difference also, by our author's reasoning, would remove the Indian astronomer into futurity, but only about half as far off from us as in the preceding instance. The tables of Varaha likewise exhibit the mean motion of the Moon greater than modern ones do, and, of course, he is not yet come into existence; but on the other hand, they must be above ten thousand years old, since the mean motion of the Moon's apogee is given slower in Lalande's tables than in them at the rate of 42′ 10.9″ in a century. These are a few of the absurdities and contradictions into which the application of the lunar theory to Indian chronology would lead us. The mistake of M. Laplace arose, as I conceive, from his overlooking the bearing which the nature of the Indian astronomy had upon his argument;—a bearing, which is strictly deducible from the data that he himself has supplied.

To return to the two articles of the English astronomer;—upon stating that, previously to the age of Brahma Gupta, the Hindoos came no nearer to determining the true length of a lunation than within 20′ 49½″ of time, he offers the following remark. "This makes an error of one day in less than six years,

* M. Laplace states that the retardation in the mean motion of either apsis of the Moon's orbit, which has accrued since the time of Hipparchus, or in the course of about two thousand years, is at the rate of nearly fifteen minutes in a century. "— j'en avois conclu que le mouvement du périgée lunaire se rallentit de siècle en siècle, et qu'il est maintenant plus petit d'environ quinze minutes par siècle, qu'au temps d'Hypparque. Ce resultat de la théorie a été confirmé par la discussion des observations anciennes et modernes."—*Mecanique Celeste*, tom. iii, p. 274. But he has also proved that the rate of retardation of the apsis is three times the rate of acceleration of the Moon herself. The secular motion of the Moon, therefore, is greater now than it was two thousand years ago, by about five minutes of his notation, or somewhat above two minutes and a half of the common sexagesimal admeasurement; and of course it will take about four thousand years more before she acquires the further secular acceleration of 5′ 38.9″;—that is, supposing the rate of acceleration to continue the same for the next four thousand years as for the last two thousand, which probably is not exactly the case, but I have no occasion here to look for more than a very loose approximation to the truth.

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which shows that the Hindus, at that period, could not determine the times of conjunctions and oppositions of the Sun and Moon for six years together correct, much less eclipses.—Vol. viii, note in p. 235. And after telling us that Brahma Gupta made his Calpa, or grand cycle, commence on a Sunday, he observes: "This is the first system, so far as we yet know, [for he had already proved the system of Varaha to be really a later one], in which the names of the days of the week and of the twelve signs [of the zodiac, each set of names exactly corresponding to the European ones] were introduced. These were probably received from the West, and the first point of Aries was fixed to that point in the Hindu sphere which corresponded with the instant of the vernal equinox, which, in the time of Brahma Gupta, was the beginning of *Aswini*. This position has therefore a direct reference to the actual time when the twelve signs were first introduced, that is to say, near 1300 years ago; though hitherto but little, if at all, attended to by writers on the Hindu astronomy, &c."—Vol. viii, note in p. 236. From combining the information supplied in these two places, it appears that the Indians were indebted to European instruction for their first approach to accuracy in determining the celestial motions, and that this improvement in their astronomy took place not long after they had completed their alphabetic system. Now I do not urge this circumstance in proof of alphabetic writing being essential to the discovery of the first elements of this science, because I admit, that the Hindoos had some rude knowledge of it for ages before; but, as I conceive, my theory of their owing the completion of their alphabet to Europeans, derives some collateral support from its being ascertained that they got instruction in another subject from the same quarter and about the same time.

Mr. Bentley speaks with hesitation of the quarter from which the Hindoos learned the names of the days of the week and of the twelve divisions of the ecliptic; but had he, with the acuteness he possessed, sufficiently considered the subject, he scarcely could have failed to penetrate it. Even Mr. Colebrook, though by no means disposed to countenance any great reduction of the antiquity of Indian science,* yet admits the probability of the Hindoos having got the

* Although Mr. Colebrook had read the admirable astronomical articles I have been referring to, previously to his writing the paper from which the ensuing quotation in the text is taken; yet in

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names in question from the Greeks. After describing the Indian division of the zodiac into twenty-seven portions corresponding nearly with the arches described by the Moon in the several days of her sidereal revolution, those days exceeding twenty-seven only by a few hours, he observes: "The Hindus have likewise adopted the division of the Ecliptic and Zodiac into twelve signs or constellations, agreeing in figure and designation with those of the Greeks; and differing merely in the place of the constellations, which are carried on the Indian sphere a few degrees farther west than on the Grecian.* That the Hindus took the hint of

this paper he clings to the notion of the extravagant antiquity of a correct celestial sphere which he supposes to have been formerly in use among the Hindoos, and expresses himself inclined to believe that the pole star in that sphere was x Draconis, "which had been at its greatest approximation to the pole, little more than four degrees from it, about 1236 years before CHRIST."—*As. Res.* vol. ix, p. 330. In the same paper he endeavours to throw a slur upon the value of the articles in question; as appears from the following passage,—the only one in it in which I can find that he has taken any notice of either of them,—"*Brahmegupta* wrote soon after that period [when the vernal equinox was near the first degree of *Mesha*]; and the *Surya Sidd'hanta* is probably a work of nearly the same age. Mr. Bentley considers it as more modern (As. Res. vol. vi.);"—*As. Res.* vol. ix, p. 329. Of course, then, Mr. Bentley was mistaken, and his discovery is of no use! Here, however, our author admits the Surya Sidd'hanta to be less than 1300 years old; and yet, a little farther on, he undertakes to prove another treatise of *Varaha*,—an astrological one, entitled the *Varahi Sanhita*,—to have been written as long ago as the time of Eudoxus. This treatise contains a chapter on the motions (unconnected with the precession of the equinoxes, and, therefore, quite imaginary) of seven stars in Ursa Major, called the *Rishis*; and from an astrological method given by a commentator for determining these imaginary motions, Mr. Colebrook draws his inference, by steps through which I will not attempt to follow him; but if the reader should lay any stress upon reasoning which rests upon such a foundation, he will find it in the place already mentioned, pp. 363-4. The whole is wound up with the following observation. "In corroboration of this inference respecting the age of Varaha Mihira's astrological treatise, it may be added, that he is cited by name in the *Pancha tantra*, the original of the fables of *Pilpay*, which were translated for *Nushirvan* more than 1200 years ago."—*Ib.* p. 364. The weakness of this indirect attack upon Bentley's method of determining the ages of the different systems of Indian astronomy, is quite on a par with the fallacy of the previous insinuation, and requires but little refutation. A deduction from imaginary motions obviously proves nothing; and the appearance of Varaha's name in the work just specified, only proves,—no matter what antiquity may be claimed for that work,—that it must have been written within the last eight hundred years.

* Mr. Colebrook here alludes to an older Indian sphere than that now in use, which, from his account of the position of the colures in it, would appear to be of great antiquity. It is barely possible that the Hindoos may have had a rude instrument of the kind long before they arrived at any accurate information on the subject of astronomy; but, from the circumstance of Mr. Bentley's

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this mode of dividing the Ecliptic from the Greeks, is not perhaps altogether improbable."—*Asiatic Researches*, vol. ix, p. 347.

The septenary division of time is so widely diffused through the East, that it may possibly have descended to different Asiatic nations independently of each other, by some remains of a tradition handed down from patriarchal times; but the *names* of the seven days had beyond all doubt a more western, as well as a more recent origin. Dion Cassius expressly attributes their invention to the Egyptians, and describes the astrological principle on which they were framed; from which, as well as from his assertion, it appears that their rotation commenced with Saturday.* But the Christians, in adopting them, changed the initial one from Saturday to Sunday, evidently because the latter coincided with their first day of the week. Dion further shows that he could not be mistaken as to the people with whom this invention originated, for he informs us that it was not an old one in his time, giving this as a reason for its having been unknown to the ancient Greeks;† and the same reason obviously accounts for its not having been

never having found one mentioned in any older treatise than that of Brahma Gupta, it is, I conceive, much more likely that the *ancient* sphere in question is only a modern fabrication of the Brahmans, after they had become aware of the precession of the equinoxes;—a fabrication contrived to give colour to the pretended antiquity of their astronomical skill.

* The inventors of the names under consideration supposed that, 1. Saturn, 2. Jupiter, 3. Mars, 4. the Sun, 5. Venus, 6. Mercury, 7. the Moon, presided constantly over the world, each by turns an hour, in the order here stated; and they called each day after the celestial body which presided over its first hour. In this manner the first day got its name from Saturn; the second, from the Sun; the third, from the Moon; the fourth, from Mars; the fifth, from Mercury; the sixth, from Jupiter; and the seventh, from Venus. That this was the original order of the astrological names of the week is proved, not only by the evidence of Dion, but also by the very nature of the case itself. For the above primary series, upon which the order of the names in the secondary one depends, is arranged according to the relative distances from the earth, which are attributed in Ptolemy's system of astronomy to the bodies he supposed to revolve round our globe. But if the rotation in the primary series be made to commence from any other body but Saturn, the order of the terms in that series will come out such as has no intelligible relation to the planetary system or any known theory respecting it.

† Τὸ δὲ δὴ ἐς τοὺς ἑπτὰ, τοὺς πλανήτας ὠνομασμένους, τὰς ἡμέρας ἀνακεῖσθαι, κατίστη μὲν ὑπ' Αἰγυπτίων, πάρεστι δὲ καὶ ἐπὶ πάντας ἀνθρώπους, οὐ πάλαι ποτὲ, ὡς λόγῳ εἰπεῖν, ἀρξάμενον. Οἱ γοῦν ἀρχαῖοι Ἕλληνες οὐδαμῇ αὐτὸ (ὅσα γε ἐμὲ εἰδέναι) ἠπίσαντο.—*Dionis. Cassii*, l. xxxvi, p. 37; Leunclavii Ed.

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introduced into India before the sixth century. Now it deserves to be noticed that the Brahmans, in applying these Pagan names to their astronomy, adopted the Christian, not the Pagan, arrangement of them; for in Brahma Gupta's system, which is the oldest in which they appear, the grand cycle is made to commence on a Sunday. If, then, it was from the Egyptians that they got those names, it must have been after this people were converted to Christianity; but from that period till the commencement of the Saracen conquests in the seventh century, not only was Alexandria, on account of its magnificent library, the principal seat of Grecian learning, but also the language of the Greeks was very generally spoken, and their literature studied in lower Egypt; as they had been for a still greater length of time up to the same epoch throughout the by far greater part of Western Asia. That the Hindoos did not learn the astrological denominations under consideration from the ancient Germans, as has by some been conjectured, is certain, not only from the comparative lateness of the period when those denominations were introduced into India, but also from the circumstance of the Sanscrit words used for the purpose agreeing in signification with the Greek and Roman, rather than with the German terms. For the Germans, in adopting this mode of distinguishing the days of the week, substituted for the names of the planets Mars, Mercury, Jupiter, Venus, and Saturn, those of their tutelary deities Tuisco, Woden, Thor, Freya, and Sater (in which substitution, by the way, they were followed by their English descendants); whereas in the Indian designations the planetary terms are retained, those designations being *Ruvi*, *Soma*, *Mangala*, *Budha*, *Vrihaspati*, *Sucra*, *Sani*, which are taken from the same celestial objects, and in the same order, as in the Greek or Roman series of denominations, as altered by the Christians. Still it has been urged, that the above Sanscrit words, after the first two, denote severally, not only the planets, but also the Gothic deities, in the order in which I have given them; as for instance, that not only the Hindoos have called the planet Mercury after their god Boodha; but also that Boodha and Woden are one and the same personage. This attempted identification, however, is wholly at variance with the characters and the names of the imaginary deities in question; for the former is represented as essentially indolent, as doing nothing, understanding nothing, desiring nothing; but the latter, as actively mischievous, the demon of battles, and slaughtering thousands at a blow. And besides, if they were the same god, they surely would

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have the same name; German terms for other meanings have been preserved in the Sanscrit, and of all words those by which a people distinguish their deities are least likely to be changed or forgotten.

The close correspondence between the Indian and Greek names for the signs of the Ecliptic, as well as constellations of the Zodiac, will be at once seen from the significations of the Sanscrit terms, as given by Sir William Jones in the following extract from one of his essays. "They divide a great circle, as we do, into three hundred and sixty degrees, called by them *ansas*, or portions; of which they, like us, allot thirty to each of the twelve signs in this order:

Mesha, the Ram.	*Tula*, the Balance.
Vrisha, the Bull.	*Vrishchica*, the Scorpion.
Mit'huna, the Pair.	*Dhanus*, the Bow.
Carcata, the Crab.	*Macara*, the Sea-monster.
Sinha, the Lion.	*Cumbha*, the Ewer.
Canya, the Virgin.	*Mina*, the Fish."

Asiatic Researches, vol. ii, p. 292.

It is absolutely impossible that so arbitrary and fanciful an application of words could have separately occurred to two different nations; and one of those in question, consequently, must have got them from the other. But the Indians had them no earlier than the sixth century; it is obvious, therefore, that they must have been the borrowing party, and that they derived this set of names, as well as that for the days of the week, from Greek instruction.

The same observation applies with nearly equal force to the employment by the Hindoos of the Metonic cycle. This cycle was formerly supposed to be exactly equal to 235 lunations; whence it was inferred, that new and full Moons occurred at precisely corresponding times of each successive series of 19 years; and, consequently, that if those times were noted for any one of the cycles in question, they would be ascertained for all that ensued. In reality the 235 lunations fall short of 19 Julian years by less than an hour and an half. This cycle, therefore, is (according to a statement of Mr. Bentley's, which has been already given) far more accurate than any employed by the Indians before the period in the sixth century when Brahma Gupta lived; whereas the Greeks made use of it for fixing beforehand the time of the celebration of their Olympic

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games (depending on the day of full Moon next after every fourth summer solstice) above four hundred years before the Christian era. The Indian astronomers, I admit, may possibly have discovered this cycle by their own sagacity; but there is evidently a much greater likelihood, that they learned it from the same source as that from which they got the twelve divisions of the Ecliptic with their names, as also the names of the days of the week.

I shall refer to Mr. Bentley's essays only on one point more, the importance of which will be perceived from the following extracts. "Two of the most ancient Hindu systems now known, and which in early times were applied to the purposes of chronology, are contained in an astronomical work entitled the *Graha Munjari*. This work is extremely valuable, as it enables us to fix, with precision, the real periods of Hindu history, with their respective durations; and to show from thence the alterations that have since taken place by the introduction of new systems."—*Asiatic Resear.* vol. viii, p. 224. "Now if we transfer the names, &c. in the four ages of the first system of the Graha Munjari, to the *Satya*, *Treta*, *Dwapar*, and *Cali* yugas [that is, to the golden, silver, brazen, and iron ages] above mentioned [of Brahma Gupta's system], and those in the Manwantaras* of the second system to the Manwantaras of the same name in this [third system]; then we shall have the periods of the Hindu history, according to modern notions, founded on the system of Brahma Gupta."—*Ibidem*, p. 237. "The Cali yuga, or iron age [of the first system], began in the year B. C. 1004."—*Ibidem*, p. 225.

Thus it appears that our author has not only convicted the Brahmans of the grossest falsehood in the claims to antiquity which they have set up for their records; but he has also pointed out the actual way in which those claims were gradually extended. The Cali yuga of Brahma Gupta is fixed two thousand and ninety-eight years earlier than that of the first system of the Graha Munjari; of course by transferring the dates of events from the one system to the other, and by giving them a corresponding position in reference to the Cali yugas of each, they are thrown farther back into antiquity in the later chronicle by more

* "The *Calpa* [of each system] is divided into lesser periods of years, called *Manwantaras* and *Yugas*; the intention of which seems to be, to assist the memory in calculating the years expired of the system; at least they answer no other purpose at present."—*Asiatic Res.* vol. vi, not in p. 546.

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than two thousand years. And unquestionably if we had access to still older systems of Indian astronomy, with their dependant chronicles or *Puranas*, we should, on comparing them with the representations on the subject that have been last imposed upon the public, find the quantity of the retrogression still greater. Mr. Bentley, indeed, seems to have thought that the earliest chronicle he speaks of, gives the dates correctly, because there is not much difference in this respect between it and the second; but as the Pandits have been to a certainty caught antedating in one of those systems of theirs that have reached us, the obvious inference from analogy is, that they practised the same kind of fraud in the others. Even in the first of them the adoption of enormous cycles is presented to our observation (and there surely is strong reason to suspect the chronology which is connected with such cycles); its Calpa, though of very diminutive size when compared with subsequent ones, yet contains 2,400,000 years. What, however, places beyond the reach of doubt the fallacious nature of the chronological part of this, as well as of the subsequent systems, is, that it refers names and events to times long antecedent to the use of alphabetic writing among the Hindoos; of which times, consequently, it is impossible that they could have any knowledge.

The next neighbours to this people, the Persians, afford a very striking instance of the actual impossibility (ever since man's age was curtailed to its present length) of any nation's preserving its history by means of oral tradition, or of such hieroglyphic writing as was employed by the ancients; and I shall conclude what I have to state for the present on the subject before me with bringing this point under the consideration of the reader. The earlier portion of the ancient history of Persia has been transmitted to us by Herodotus; and the most interesting and remarkable part of it,—that which is connected with the life of Cyrus,—has also been recorded by Xenophon. The latter, indeed, embellishes his narrative with speeches of probably his own invention; which, however, are most appropriate to the characters, as he had been told them, of the parties about whom he writes. But, with respect to facts, no doubt can be reasonably entertained but that he, as well as the former author, paid the strictest attention to truth, in relating them faithfully as they had been described to him; and both historians had opportunities of gaining the best information that was accessible in their respective days. Yet they differ most materially from each other in the

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beginning and ending of their accounts of Cyrus; and that too, upon points on which it is impossible that writers, with their dispositions and advantages, could have differed, if Persia had in ancient times possessed records that were permanently legible. Herodotus makes this extraordinary personage the son of a man of low condition, who commenced his public life with rebellion and usurpation; Xenophon represents him as the son of a king, who succeeded to the thrones of Media and Persia by regular inheritance, after the most exemplary loyalty and obedience to his predecessors. According to the earlier historian he came to a disastrous end in a foreign land, and having engaged in a war of unjust aggression against the Scythians, lost his life in battle, overcome by savages, and overreached by a woman; according to the later one, he never once was defeated, but after a long and uninterrupted career of victory and conquest, spent the close of his reign in peace and tranquillity at home. These differences as to the commencement and termination of so public and important a life, are wholly incompatible with the supposition of accounts having been written while the events in question were recent, and of the records thus formed having continued legible up to the times of our two historians; but they are precisely the sort of changes which national vanity, in the absence of such documents, would prompt the Persians to make in the history of their favourite hero; and they appear to have arisen in the very way in which misrepresentations of the kind may be conceived most naturally to have been produced. Herodotus read his celebrated historic work at the Olympic games not more than seventy years after the time of Cyrus,* yet he in it alludes to reports already propagated different from the

* I have here placed the recital of Herodotus a little earlier than it is usually fixed. The time of this occurrence is not, I believe, directly specified by any ancient author; but it can be collected from the age of Thucydides, combined with an anecdote told of him by Suidas, that he was then only a boy, and wept with emotion at hearing what was read out by the father of history. Θουκυδίδης . . . . οὗτος ἤκουσεν, ἔτι παῖς τυγχάνων, Ἡροδότου ἐπὶ τῆς Ολυμπίας τὰς ἱστορίας αὐτοῦ διερχομένου, ἃς συνεγράψατο· καὶ κινηθεὶς ὑπό τινος ἐνθουσιασμοῦ, πλήρης δακρύων ἐγένετο. Thucydides was, according to Aulus Gellius (Noct. Att. l. xv, c. 23), forty years old at the commencement of the Peloponnesian war; and that war broke out (see Beverege's Chronol. p. 147) in the second year of the LXXXVIIth Olympiad. He, therefore, was born in the second year of the LXXVIIth Olympiad; and, consequently, was ten years old at the LXXXth celebration of the games, and fourteen at the LXXXIst. The following one cannot be taken into account, as he was then passed the age assigned to boyhood among the ancient Greeks. Of the two ages of Thucydides

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narrative he gives of the birth and death of that sovereign; but they were then so notoriously false, that he did not think it worth while to specify them.* In, however, about sixty years after, when Xenophon collected his materials while living on terms of intimacy with Persians of rank in the army of Cyrus the younger, all vestiges of the older accounts, it would appear, were lost in Persia; for he takes not the slightest notice of them, but confines himself to statements that were, in all probability, of more recent origin, and among those which had been rejected by the more ancient writers as utterly unworthy of credit.

which are compatible with the above anecdote, the former is better adapted to the part of it which describes his bursting into tears; and this would fix the recital in question to the year B. C. 460; that is, sixty-nine years after the death of Cyrus, and fifty-nine before the battle in which the younger prince of that name lost his life.

* Herodotus intimates, in a manner that cannot be mistaken, the falsehood of the reports rejected by him; particularly of those respecting the birth and early part of the life of Cyrus; in allusion to which he says, "As then certain of the Persians relate, who do not wish to extol beyond measure the concerns of Cyrus, but to tell the actually true account, according to these statements I shall write." Ὡς ὦν Περσέων μετεξέτεροι λέγουσι, εἰ μὴ βουλόμενοι σιμνοῦν τὰ περὶ Κῦρον, ἀλλὰ τὸν ἐόντα λέγειν λόγον, κατὰ ταῦτα γράψω.—*Herodoti*, l. i, c. xcv. It is moreover to be remarked, that our author does not refer to written accounts in the hands of the Persians, either here, or in the place where he alludes to the different reports respecting the death of Cyrus; in each place he only mentions spoken ones; and here says he will *write* what was *told* him by others. The consequence is, that while he speaks with certainty and from his own knowledge of the manners and customs of the Persians (showing thereby that he had actually gone to Persia, and spent some time there for the purpose of getting the best information); he does not by any means express himself with the same confidence respecting the history of that nation. I would not, however, have it inferred from the remark just made, that the Persians had at this time no writing of any sort in use among them; but merely that they had not a great deal, and that they had none which Herodotus could read. It cannot be maintained that they had none whatever, as in the early part of this author's account of the life of Cyrus (Lib. i, c. cxxiii), he mentions the circumstance of a letter having been sent to that prince, concealed within the body of a hare, from a nobleman of the court of Astyages. But from his having derived his information immediately from Persians, and having lived among them upon terms of intimacy, it is evident that he must have understood their language; and, therefore, supposing they had any historic records, he would in all probability have learned to read them, if they had been alphabetically written. I should not rely much on this proof of the Persian writing having been hieroglyphic at the time in question, if it stood alone; but it is, I submit, entitled to some consideration, inasmuch as it falls in with, and thereby serves to corroborate, the more decisive one which is given in the text, derived from discrepancies, between Herodotus and Xenophon, that cannot possibly be accounted for in a satisfactory manner on any other supposition with respect to the nature of that writing.

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Where the two historians differ, the preference, as I conceive, is manifestly due to the representations of the older, as he lived nearer to the time of the events he records; but as it has been attempted to enlist Scripture on the side of the younger, I must observe that the sacred volume decides nothing between them. It has been urged that Xenophon's character of Cyrus being the more favorable one, is that which is more entitled to credit; because Isaiah calls this conqueror the anointed of the Lord (Is. xlv, 1), that is, his appointed one for a particular service. But in the third verse after, the Prophet states that Cyrus knew not the true God; and consequently he did not act from any principle of obedience to the Almighty. Surely bad men, as well as good, are instruments in the hands of Providence, whose ends they may be promoting, when they are least influenced by any such intention, and are least conscious of their actions having such a tendency. The soldiers who were engaged under Cyrus in the service in question, namely, in the taking of Babylon, are in like manner called by the same Prophet, speaking in the name of the Lord, "my sanctified ones,"*—*Isaiah* xiii, 3; and just in a similar point of view, and when destined for a similar employment (the chastisement of a rebellious people), Nebuchadnezzar is termed by another Prophet, "my servant,"—*Jer.* xxv, 9. Yet it evidently would be quite unwarrantable hence to infer, that the individuals composing the immense armies which on the above occasion besieged Babylon, were all saints, or that Nebuchadnezzar was a righteous man. Another argument brought forward in favor of the later historian, is founded on the prophecy of Isaiah, in which he formally and expressly denounces against Babylon its siege by the Medes and Persians, and obscurely alludes to its capture through stratagem, and its spoliation by those people;†—a prophecy which was in every particular fulfilled;

* The original meaning of קדשׁ, the root of the Hebrew word here employed, is "to separate"; from which is derived its secondary meaning of "to sanctify." The primary signification of the term seems more appropriate to the use made of it by the Prophet in this place; where he speaks of those who, in the counsels of the Almighty, were set apart as the agents destined to bring about a certain event.

† The prophecy above referred to, is contained in the following passage of the Bible. "A grievous vision is declared unto me; the treacherous dealer dealeth treacherously, and the spoiler spoileth. Go up, O Elam; besiege, O Media."—*Isaiah*, xxi, 2. The obscurity in which this passage has been hitherto involved, is, I submit, in a great measure removed by a just view of the character of Cyrus. It is from a misconception on this point that commentators have, in opposition

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but surely it was equally so, whether we suppose, with Herodotus, that the nations from which the besiegers were principally drawn, had but one common sovereign, or with Xenophon, that they then were ruled by two in alliance with each other. The distinct character of the Medes and Persians is no more destroyed by the supposition of their being under the sway of a single monarch, than that of the besieging armies is, by their being under a single general, on which latter point both historians are agreed. Scripture, therefore, leaves the question entirely open, as to which writer is more to be relied on, when they differ; but certainly it gives strong support to both of their accounts of the taking of Babylon, by the remarkable accordance with circumstances predicted by the prophets which each account exhibits.

Indeed it was quite impossible that the main facts of so eventful a life as that of Cyrus,—except such as were less creditable to him, and which national vanity very soon interfered to distort,—could have been wholly altered or forgotten in the space of 130 years, even by a people who had no more durable mode of preserving the memory of them than oral tradition. Accordingly we find our two historians agreeing on many prominent points; they both make the father of this remarkable man, a Persian named Cambyses; and his mother, the daughter of Astyages, King of the Medes; according to both, he conquers Crœsus, seizes his kingdom, and spares his life; according to both, he takes Babylon by the stratagem of making outlets for the river which ran through it, thereby suddenly drawing off the waters, and thus gaining an admission for his troops into the town by night through the dried channel. In these particulars, and perhaps in some more in which Herodotus and Xenophon agree, the truth of their respec-

to not only the Hebrew text, as it now stands, but also the Septuagint version, ventured to attach a passive sense to the verbs in the first part of the prophecy, in order to shift the application of it from Cyrus to the Babylonian king. Thus Bishop Lowth has construed the sentence in question. "The plunderer is plundered, and the destroyer is destroyed." And William Lowth, though by a different but very forced translation, has virtually given the same meaning of the sentence. To justify such an alteration, the *Waw* in the words of the original, בֹּגֵד and שֹׁדֵד, should be transferred from the first to the second syllable of each; and I admit that before the Hebrew text was vocalized, these words might be read in either way. But where the early vocalizers, the Masorets, and the Greek translators, have all agreed in limiting the sense to that indicated by the present reading, the case should be very strong indeed, which would warrant our changing it in opposition to their combined authorities.

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tive narratives cannot, I will venture to assert, be rationally doubted.* With respect to the subsequent portion of the ancient history of Persia which Herodotus has given, it is *a fortiori* to be relied on, as coming so close to his own time; not that he is to be implicitly followed in every thing he tells, for no uninspired writer was ever wholly free from error, and he particularly, though an evident lover of truth, was very credulous; but the general correctness of his narrative in its leading features must, I conceive, be acquiesced in. After him the continuation of this history was, in consequence of the increased intercourse between Greeks and Persians, undertaken by so many writers, that a judicious comparison of their works has enabled the moderns in Europe to arrive very nearly at certainty in reference to the principal facts.

If now we turn to the accounts at present in the possession of the Persians respecting the ancient history of their country, we must be struck by their total silence as to every one of the circumstances relative to Cyrus which have been above enumerated; and by the blank they exhibit not only as to these, but also as to every other event of importance which occurred in Persia down to the time of its conquest by Alexander the Great. Their writers, indeed, give us long lists of Persian sovereigns, which, as a matter of course, they extend backwards to the highest date assigned to the deluge;—a practice of which all nations avail themselves who have from any source got even the most obscure idea of that catastrophe, but are wholly ignorant of their own ancient history. But if we examine the actions of those sovereigns, we shall find that they are engaged almost exclusively in wars with the Turanians or Tartars; that is, with the nations with which the Persians had chiefly intercourse for the last 1500 years; so that all their historians have been able to effect was, either to transfer lives

* In comparing those two writers I have not taken into account Ctesias, the cotemporary of the latter; because very little of his history has been preserved, and that little cannot be at all depended on, as he wrote under the control of a despotic monarch accustomed to the most servile flattery. There is, however, one point in his narrative worth noticing. He makes the duration of the Assyrian empire, previous to the revolt of the Medes, to be 1300 years; while Herodotus rates it only at 520.—Lib. i, c. 95. This discrepance has puzzled chronologers in no small degree, in consequence of their overlooking the want of alphabetic writing among the Persians in the time of the two historians; but it is just such as might be expected to arise, in the course of the sixty or seventy years that intervened between them, from the natural tendency of tradition to augment the antiquity of dates, wherever it has been unchecked by documents of permanent legibility.

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which had existed within this period, beyond it, or to fabricate lives of the same kind, in order to fill up their account of times that were utterly unknown to them.

These writers distinguish the families that ruled over Persia, previously to the Arabian conquest, into four dynasties;—the *Pishdadians*, the *Kaianians*, the *Ashkanians*, and the *Sassanians*;—of which the second was terminated by the Macedonian conquest. I here subjoin the Kaianian race, as also the Median and Persian dynasties of the Greek historians to which it is supposed to correspond.

PERSIAN LIST.	GREEK LIST.
.....	Dejoces.
.....	Phraortes.
Kaikobad.	Cyaxares I.
Kaikaus.	Astyages.
.....	Cyaxares II.
Kaikhosrou.	Cyrus.
Lohorasb.	Cambyses.
Kishtasb.	Darius.
.....	Xerxes.
Ardeshir or Bahaman.	Artaxerxes.
.....	Darius Nothus.
Queen Homai.	.....
.....	Artaxerxes Memnon.
Darab I.	.....
.....	Ochus.
Darab II.	Darius Codomannus.
Eskander.	Alexander.

The names in the two lists which are fancifully assumed to belong to the same individuals, are here placed respectively on the same lines; but in point of fact there is not the remotest resemblance in the histories of the persons, thus compared, until we come down to the very last name upon each list. And how very little congruity there is even here, will be seen from the following abstract of the concluding part of the Persian account of the Kaianian dynasty; which I take from the *Dissertation on the Languages, Literature, and Manners of Eastern*

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Nations, prefixed by Richardson to his Persian, Arabic, and English dictionary, London, 1806.—"Bahaman, the sixth king of the Kaianian dynasty, had married his daughter Homai, whom he left pregnant at his death; disinheriting his son Sassan, in favor of this lady and her offspring. Homai was declared heiress of the empire, if not delivered of a son, and regent, in that event, till he was of age to reign. Averse even to the distant prospect of resigning sovereign power, the queen ordered the birth of her son to be concealed; and sent him privately to be exposed in a casket on the banks of the Gihon; the rising of the waters soon swept him away, and threw him on a dyer's bleaching ground. The rich stuffs and valuable jewels, which the poor man found in the casket, convinced him that he was a child of elevated birth; he educated him, however, as his own son, and wished him to follow his profession; but the prince, unwilling to believe himself the son of a dyer, urged his reputed father so strongly, that the good man discovered at length all he knew; and delivered to him the jewels which he had carefully preserved. Young Darab determined immediately on the profession of arms; and set out for the army, which was then marching against the Greeks. He arrived on the eve of a battle; in which he distinguished himself with such heroism, that his fame reached the queen. The prince was sent for; Homai was struck with his presence; she discovered him by the jewels and the old man's testimony, and resigned the diadem to him, after having reigned with great reputation about thirty years. This Darab is represented as an accomplished prince, and a successful warrior. Philip of Macedon, amongst others, according to Khondemir, drew upon him his resentment, by refusing to acknowledge his authority. He marched against him; and, forcing him to take refuge in a fortress, Philip sued for peace, which was granted, on condition of giving his daughter in marriage to the Persian king, and paying an annual tribute of a thousand *beizets*, or eggs of gold. The young queen did not please her royal consort; though pregnant, he returned her to her father's court, where she was afterwards delivered of the famous Alexander, whom Philip educated as his son; and left him his kingdom, with the secret of his birth. Darab having, in the mean time, espoused another lady, she brought him Darab the younger; who mounted the throne on the demise of his father. This prince is represented by the historians of the East in very different colours from the gentle and amiable Darius Codomannus. His cruelties and oppressions rendered him

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detested in Persia; and the great lords exhorted Alexander to assert his right to the empire. Encouraged by those general discontents, he resolved upon the attempt; and, as a leading step, informed the ambassadors of Darab, when demanding the annual tribute of the golden eggs; 'that the bird who laid them, had flown to the other world.' This refusal, with the raillery which accompanied it, enraged the King of Persia. He marched immediately, to reduce the Macedonian to obedience. The monarchs met; a bloody battle ensued; and Darab was worsted. He retired to his tent, to take some repose before renewing the engagement; but was stabbed by two of his attendants, who fled immediately to the Grecian camp. Alexander, informed of the murder, hastened to Darab's pavilion; he found him in the agonies of death; he threw himself on his knees, wept, and protested his ignorance of the treason. The dying prince believed him; named him as his successor; gave him his daughter Roshana in marriage; requested him to revenge his assassination; to govern Persia by Persian nobles; and expired in his arms. Alexander, they add, chiefly by the counsels of Aristotle, whom they call his Vizir, punctually fulfilled these last injunctions of the dying king; the great men of Persia being appointed to the government of the provinces and dependent kingdoms; which they were permitted to hold on feudal principles of homage, subsidies, and military service, to their conqueror, as paramount sovereign of the empire.—Here is a detail which corresponds with the writers of Greece and Rome in nothing but the catastrophe; and yet, in the whole annals of Persia, there is not, perhaps, a single passage which boasts a more intimate agreement."—*Dissertation*, &c. pp. xviii, xix.

Mr. Richardson seems to have conceived that the ancient Grecian accounts are preferred to this one by Europeans, merely because the mind is prejudiced in favor of the statements with which it is first acquainted; but surely the inherent improbabilities and inconsistencies in the narrative before us are, even without any reference to older documents, sufficient to prove it a gross fabrication. We have here a father disinheriting his son in favor of a daughter, and the son, with the nation at large, submitting to this decree without resistance;—the daughter endeavouring secretly to destroy her only child, a son, to whose preservation alone she could look with confidence as the means of ensuring to her protection in old age;—that son passing his life in poverty and ignorance up to thirty years of age, and yet immediately after turning out a most accomplished

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prince;—and so on. It is unnecessary to pursue this view of the subject farther; but if the passage be considered in all its bearings, it will be found by far more adapted for the *Arabian Nights' Entertainments*, than for a place in the pages of real history.

But to revert for a moment to the two lists;—the ground on which it is imagined that Kaikhosrou is the same person as Cyrus, is because the Persian authors represent him as a prince who was exposed in his infancy, brought up by people of low condition, and discovered, when arrived at manhood, to be of royal birth;—circumstances, by the way, which have no analogy to the history of Cyrus as given by Xenophon, but only to that transmitted to us by Herodotus; and which would equally serve to identify Darab with the ancient hero of Persia. In every other respect the two characters here compared are totally different from each other; and the pairs placed immediately above* and below the one just considered, are composed of equally discordant parts. Let us, however, for an instant assume that the preceding names belonged to the same individual, in order to try if this will assist us in the identification of the principal pair; and then we shall find so far, indeed, a correspondence, that Kaikhosrou is the grandson of his immediate predecessor, but not by his mother's side; the Persian historians give him this relationship through his father, whom they describe as the eldest son of Kaikaus, and state that his mother was the daughter of a Tartar king. Yet Sir William Jones was so possessed with the notion of the identity of the characters under consideration, that, in his sixth discourse on the Persians, he declares,—"I shall then only doubt, that the *Khosrau* of *Firdausi*, was the Cyrus of the first Greek historian, and the hero of the oldest political and moral romance, when I doubt that Louis *Quatorze*, and Lewis *the Fourteenth* were one and the same French king."—*Asiatic Researches*, vol. ii, p. 45. Even in the particulars of the birth and early life of the two heroes, on which alone Sir William had to rely for the identity he insisted upon, there is a discrepance which is quite sufficient to prove them different persons; and I do not hesitate to assert, that the imaginary character which he wished to fasten on the Grecian portrait, belongs much more appropriately to

* In this comparison Cyaxares II. is passed over, as not forming one of a pair, there being no sovereign to correspond to him in the Persian list; and besides, he is not found even in the Grecian list, as far as it is given by Herodotus.

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the Persian representation. Both points will, I apprehend, appear very evident from the following abstract of the Persian account, which I quote from Dr. Hales's Chronology, although the Doctor does not himself seem to have been aware of the direct bearing of his own statement. "Mirkhond represents Kaikosru, or Cyrus, as the grandson of Kaikaus, by his eldest son, *Siavek*, who was assassinated shortly after his birth; and Khosru was then concealed by his mother, *Franghiz*, the daughter of the king of Turan. Kaikaus long sought his grandson, who, at length, was discovered at a hunt, by a Persian nobleman, and brought to the Persian court, received with great joy, and made commander-in-chief [is there no romancing here?] of the Persian forces. That some time after, a competition for the succession to the crown took place between Cyrus and his uncle, *Fraiborz*, or Cyaxares, the surviving son of Astyages. [In the two lists the name Cyaxares, on its first occurrence, where it forms one of a pair, is matched, not with Fraiborz, but with Kaikobad. Dr. Hales certainly had a very strange way of identifying characters, and it would be difficult to decide, in reference to the several persons whom he here confounds together in pairs, whether those of each pair were more unlike one another in names or in the whole course of their actions]. When Astyages, unwilling to decide between his son and grandson, told them both, that he would appoint his successor, whichever of the two should first, with equal forces, reduce a rebel town, investing it on both sides. The skill and valour of Cyrus prevailed, and to him the town surrendered. Whereupon, his grandfather declared him his heir; and soon after retired from the world to solitude, and left Cyrus in peaceable possession of the kingdom."—*Hales's Chron.* vol. iii, p. 94.

Upon the total difference which subsists not only between the lives of Kaikhorsrou and Cyrus, but also between every part of the Grecian and Persian representations of the ancient history of Persia, the opinion of Richardson is valuable, because he was most extensively conversant with Persian and Arabic literature. "From every research (he says, in the dissertation I have already referred to) which I have had an opportunity to make, there seems to be nearly as much resemblance between the annals of England and Japan, as between the European and Asiatic relations of the same empire. The names and numbers of their kings have no analogy; and in respect to the most splendid facts of the Greek historians, the Persians are entirely silent. We have no mention of the

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Great Cyrus, nor of any king of Persia, who, in the events of his reign, can apparently be forced into a similitude. We have no *Cræsus*, king of Lydia; not a syllable of *Cambyses*, or his frantic expedition against the Ethiopians. *Smerdis Magus*, and the succession of *Darius*, the son of *Hystaspes*, by the neighing of his horse, are to the Persians circumstances equally unknown as the numerous assassinations recorded by the Greeks. Not a vestige is, at the same time, to be discovered of the famous battles of *Marathon*, *Thermopylæ*, *Salamis*, *Platæa*, or *Mycale*; nor of that prodigious force which *Xerxes* led out of the Persian empire to overwhelm the states of Greece. Minutely attentive as the Persian historians are to their numerous wars with the kings of Turan or Scythia; and recording, with the same impartiality, whatever might tarnish as well as aggrandize the reputation of their country, we can with little pretence to reason suppose, that they should have been silent on events of such magnitude, had any records remained of their existence, or the faintest tradition commemorated their consequences."—*Dissertation*, &c. p. xvi.

The reasoning of our author at the conclusion of this extract is, so far, quite correct; but where he, as I conceive, fell into error, was in the tacit assumption that the Persions actually had records of all events which in early ages occurred in their country, from which he was necessarily led to the inference, that the Greek accounts respecting those events were mere idle fictions, without any real foundation:—a paradox so monstrous, that at times he is forced to shrink from it, and very inconsistently to admit, that there may be some truth in the older European statements. The only way of our escaping from the dilemma in which he was placed, is that which I have already suggested. The Persians, it has been proved, had in reality no permanent mode of recording events in ancient times, nor is it likely that they had any, till long after those in question had taken place; and this consideration sufficiently accounts for the total ignorance they now betray upon the subject;—an ignorance which cannot upon any other ground be rationally explained. They adopted the Arabic writing along with the Mohammedan creed; and previously, the Syriac writing, which, it is most likely, they learned at the period when, during the reign of Constantine, they were converted to Christianity. Whether they had before the last-mentioned epoch the benefit of any alphabetic mode of designation is, I conceive, very

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questionable;* they were, indeed, for a long time under Greek rulers, but so were the Egyptians, and yet it is certain that this latter people had no alphabetic writing of their own till they became Christians. Analogy therefore would lead us to a corresponding inference with respect to the Persians; but at all events it is, I submit, clear, from the specimen I have given of their history of the latter part of what is called by them the Kaianian dynasty, that they could not have had any durable mode of preserving the memory of events till long after the termination of that dynasty. If, for instance, they had got any better writing than hieroglyphs within two hundred years of the period in question, it is quite impossible that they could have made such a nonsensical medley as they have, of the life of Alexander the Great. Still, however, from the time they came under Greek dominion, the government documents must have been in Greek; which circumstance would indirectly contribute to render their national writing more permanently legible, by affording a standard of reference. The effect of this is visible in the approach, made at the end of the Kaianian list, to the names of real history. Thus, I submit, is laid open to our view the mysterious cause why the Persians should be wholly ignorant of the ancient history of their country;—a cause which has operated exactly in the same way in the case of every Asiatic nation to the east of Persia. But I shall have an opportunity of placing this matter in a much stronger light when, in the prosecution of the work with which I am engaged, I come to treat of the language, the writing, and the history of China.

* The Persepolitan inscriptions, which are probably the oldest now extant in Persia, are written in Syriac letters of an ancient form.

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III. *On the Years and Cycles used by the Ancient Egyptians. By the* Rev. Edward Hincks, D.D. (Communicated by the President.)*

Read 9th April, 1838.

MUCH has been written on the subject of the Egyptian year; but I apprehend that no correct information respecting it is any where to be met with. It has been generally stated, that it *originally* consisted of 360 days; and that at some epoch, on which authors are not agreed, five additional days were annexed to it, in order to approximate more closely to the length of a solar revolution.

In opposition to this received opinion, I venture to lay before the Academy the five following propositions, which I hope to be able to establish in succession.

1st. In the early part of the eighteenth century before the Christian era, there occurred a marked chronological epoch in Egypt.

2nd. *Before* this epoch, the Egyptians used a year, of which the commencement took place at a fixed astronomical season, and the average length of which was, consequently, that of the tropical year; while *after* this epoch they used the wandering year of 365 days.

3rd. Between this chronological epoch and the year of our Lord 34, there elapsed *six* cycles, of some sort or other.

4th. The nature of these cycles was such, that in one of them the astronomical phenomenon, which had marked the commencement of the old fixed year, travelled forward through a fifth part of the wandering year, or seventy-three days; and, consequently, that in five such cycles that phenomenon returned again

* To prevent the possibility of misconception, it seems proper to state, that this paper was not sent to the President until finished; and, of course, that he is not responsible for the accuracy of any statement, result, or reasoning that it contains; having merely had the kindness to communicate to the Academy what was transmitted to him for that purpose.

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to the commencement of the wandering year, having taken place on every day of it.

5th. The length of each of the smaller cycles was 300 years. Consequently, the epoch when the wandering year was introduced was 1767 B. C.; and the first day of the first year was the 8th November, 1767, according to the proleptic Julian reckoning.

Of the truth of the two first of these propositions I have long been convinced. The three last are the result of an investigation, which was suggested to me by a reference to a passage in Tacitus, which I noticed in an article on the Pyramids in Fraser's Magazine for November, 1837. On examining the passage referred to, I felt convinced that the ingenious author of the article had drawn an incorrect inference from it; and, endeavouring to ascertain what information it really conveyed, I became satisfied of the truth of the third of the above propositions. From this I soon passed to the fourth and fifth, the latter of which, being the grand result, to which the rest are subsidiary, I have since been able to confirm by independent arguments.

I. The first proposition I by no means offer as a *new* one. It is an obvious consequence of the discoveries of the late lamented Champollion, respecting the hieroglyphical notation of the year; and it must be at once acquiesced in by all who are acquainted with those discoveries. I shall, however, say a few words in explanation and support of it.

It was demonstrated by Champollion that the Egyptians divided their year, exclusive of the Epagomenæ, into three seasons; and that they denominated them hieroglyphically the first, second, third, and fourth months of these three seasons. He interpreted the characters which stood for the three seasons to mean, respectively, vegetation, ingathering, and inundation. Whatever doubt there may be as to the correctness of the two former interpretations, there can be none as to the last. It is beyond all question that the hieroglyphic names for the four last months of the year are the first, second, third, and fourth months of the inundation. Now, as the Egyptian year of 365 days was in its nature a wandering one, and as any given day of it would in course of time pass through all the seasons of the solar year, it follows that the seasons of the wandering year would *sometimes* coincide with those seasons of the fixed year, of which they bore the names. These epochs of coincidence between the wandering year and

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a supposed fixed year are easily discoverable; and of this kind is the epoch, of which I speak in this proposition. We know that the inundation commenced about the summer solstice. In order, then, to discover the years in which the required coincidence took place, we have only to ascertain the years in which the summer solstice fell on the 241st day of the Egyptian year. *Perfect* accuracy is, of course, not to be expected. The solstice would, in fact, occur on this day for four successive years, and the fluctuations in the seasons arising from meteorological causes, as well as the difficulty of making an exact observation of the first rise of the Nile, would leave room for an error of perhaps twenty years on either side of the year determined by calculation. I mean to say that in any of these forty years the seasons of the wandering year could not be *observed* to differ from those seasons of which they bore the names.

Now, I find by calculation, that on the 241st day of the Egyptian year, which commenced on the 30th October, 272 B. C., that is to say, on the 27th June, 271 B. C., the solstice occurred shortly after the Egyptian noon. We may then reckon from 291 B. C. to 251 B. C. to be a period of apparent coincidence between the seasons of the wandering year and those seasons of the true year after which they were called; and the epoch of coincidence, *as observed by the Egyptians*, must have fallen between these extremes, though it would not necessarily fall in the middle year 271, which is pointed out by astronomical calculation. Going back through all the seasons, I find again that on the 241st day of the Egyptian wandering year, proleptic or actual, which would or did begin on the 11th November, 1780 B. C., that is, on the 9th July, 1779 B. C. the solstice occurred about Egyptian noon. This gives for the period of apparent coincidence 1800 B. C. to 1760 B. C.; and I am justified in saying, that within these limits a remarkable chronological epoch must have occurred.

II. Thus far, as I have already intimated, I have advanced nothing but what will be generally admitted by those who have given their attention to hieroglyphical discoveries. I now, however, bring forward a proposition, in maintaining which I believe I stand alone, namely, that up to this chronological epoch, which I have last mentioned, the Egyptians used a year, of which the average length was that of the tropical one, its commencement being marked by a phenomenon, depending on the sun's annual revolution.

It is, in the first place, manifest, that the hieroglyphical notation of the

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months must have been adopted at a time, when the seasons of the actual year, of whatever sort that may have been, coincided with the seasons represented by their names. This is a proposition, which cannot, I think, be questioned; and it furnishes us with a criterion, by which we may at once reject many suppositions respecting the origin of the wandering year as *impossible*. The only hypotheses which will stand this test, besides that which I have stated above, are the following:—1. That the year of 365 days succeeded a year of 360 days at the chronological epoch of the eighteenth century, the hieroglyphical notation of the months being then first used; 2. That at this chronological epoch the hieroglyphical notation of the months was introduced; the year of 365 days having been previously in use, but the months having been otherwise noted; 3. That the hieroglyphical notation was first used for a year of 360 days; 4. That the year of 365 days, with its hieroglyphical notation, was introduced at a chronological epoch similar to that of the eighteenth century before our era, but occurring in the thirty-third century before it. In deciding which of these several suppositions is the correct one, we have to consider their intrinsic probabilities, and also the testimony of ancient authors, so far as this has been given in favor of, or in opposition to, any; and it will be well for me to state, in the first instance, that the argument that I am about to use is a disjunctive syllogism. I hope to be able to show, that all the suppositions, which I have above enumerated as *possible*, in reference to the criterion first laid down, except only that which I have stated to be my own, are either highly improbable—I may even say absurd, or are altogether opposed to the testimony of antiquity. On the other hand, I maintain that my own hypothesis is both intrinsically probable, and conformable to the testimony of such ancient authors as have alluded to the subject.

1. The first of the four hypotheses, which compete with my own, must, I conceive, be rejected on account of the extreme improbability that the Egyptians should have continued to use a year of 360 days so late as the beginning of the eighteenth century before our era. A great number of centuries must then have elapsed since the peopling of Egypt, even according to the lowest biblical chronology; the inhabitants must have had considerable intercourse with neighbouring countries; and we know that they had attained to no small degree of civilization. Can we then suppose with any reason, that, up to this late period, they should know no better than to measure their time by a year of 360 days;—

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a year, which, while it had no relation to the phases of the moon, would have represented so inaccurately the course of the sun, that its commencement would pass in thirty-five years from midwinter to midsummer, and in seventy would go through the entire round of the seasons? That such a year should have been tolerated *for centuries* in *any* country, and more especially in Egypt, where the striking annual phenomenon of the inundation must have attracted the attention of every individual, is, in my judgment, a supposition which cannot be entertained for a moment. It is alleged, however, by its advocates, that the testimony of antiquity is in its favour. I readily admit that there has been a very general consent among *modern* authors, as to the supposed fact of a year of 360 days having been in use before the year of 365 days; but I deny that any author, who deserves to be called *ancient*, has given countenance to such an opinion. Plutarch, indeed, records a fable, that "the Sun, having discovered the infidelity of his wife Rhea, prevented her by a curse from bringing forth her offspring on any of the 360 days of the year; but that Hermes, playing at dice with the Moon, won five additional days, on which Osiris and his brothers and sisters were born." Such is the only *ancient* authority in existence for a year of 360 days having *ever* been in use; and it is evident that this authority, by throwing back the *disuse* of that year to the mythological epoch of the birth of Osiris, does in fact negative the supposition that a year of 360 days was ever used in the times of real history. There was, however, in the eighth century after the Christian era, a monk of the name of Georgius, (usually called, for distinction, Syncellus,) who compiled a Chronography, in which he has preserved some valuable fragments of the works of ancient authors that are lost. This writer is usually appealed to as an authority for the existence of a year of 360 days; and he certainly has asserted its existence; but then he has not asserted it on the authority of any more ancient writer, and this makes all the difference in the world. If a statement to this effect had occurred in a quotation made by Georgius from Manetho, or any ancient author that he named, that statement would have weight, arising from the antiquity or character of that author. In the present instance, however, the statement is that of Georgius himself; it is the mere expression of the opinion of a writer of uncommonly weak judgment, who lived so late as the eighth century; and it is consequently altogether worthless. I insist the more on this point, because I have seen this statement of

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Georgius quoted as a statement of Manetho. Georgius gives, indeed, copious extracts from Manetho, as transmitted both by Africanus and by Eusebius; and in these extracts he mentions several facts respecting different Egyptian kings; but the passage in which he speaks of the year does not occur in any of these extracts. It is to be found (page 123 C. D. Paris edition) in the Catalogue of Egyptian Kings, which he gives *as his own*;—a catalogue, which is universally admitted to be full of the grossest errors, so as to be utterly unworthy of notice. In that catalogue he mentions a king, whom he calls Asseth; he places him immediately before Tethmosis or Amosis, and he elsewhere says that he was the father of Tethmosis. No such king is mentioned either by Africanus or Eusebius; and Josephus calls the father of Tethmosis Alisphragmuthosis. There was, therefore, some reason for Scaliger to wonder, "whence Georgius fished up this king Asseth." Josephus, however, mentions a king Assis, the last of the shepherd sovereigns; and this appears to have been the Asseth of Georgius. It is true, that, according to Manetho, as preserved by Josephus, the reign of Assis terminated 251 years before that of Tethmosis began; and that Assis was one of the Shepherd conquerors, while Tethmosis was the native prince who expelled them. These would be no objections in the eyes of Georgius. It would be quite in accordance with his peculiar method of cataloguing kings to place these two sovereigns in the relation of father and son! After mentioning Asseth, Georgius makes the following remark:—"He added the five additional days of the years; and in his time, as they say, the Egyptian year was appointed to consist of 365 days, when it before this was composed of only 360." Here we have the statement, which later writers have so generally acquiesced in; and we have it *repeated* in the same sentence, apparently for greater emphasis; but it still rests on the authority of Georgius only; and I can by no means esteem the authority of a blundering writer in the eighth century, as sufficient to establish a fact, which is intrinsically so improbable. But, it will be objected, would Georgius have been likely to invent such a statement? Must he not have had some foundation for it in some ancient writing now lost? I grant that it is improbable that he fabricated such a statement *without foundation;* but I think there is every probability that he misunderstood the statement of the unknown author which served him as a foundation. In the *double* statement of Georgius we may, I think, discern the original text of the unknown writer and the glosses

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of his ignorant copyist. The clause in which he inserts the words of quotation, (ὥς φασι,) I take to have been copied, and to contain a statement which is probably true; the preceding and following clauses I believe to be Georgius's own, and to contain his blundering gloss on the original statement, and his re-assertion of it when perverted by that gloss. I conceive that the unnamed author simply made the following statement. "In his time"—it is uncertain whether he is speaking of Assis, the shepherd, or of the father of Tethmosis; but it is certain that these were not identical, as Georgius imagined;—"in his time the Egyptian year was appointed to consist of 365 days." The chronological epoch of the eighteenth century before Christ might very well occur in the reign of Assis, the shepherd, if the chronological system of Mr. Cullimore be correct; or in that of the predecessor of Amos, the founder of the eighteenth dynasty, if Champollion and Rosellini be in the right. Now, the author of this statement may have intended to point out the reign in which the wandering year of 365 days succeeded the old fixed year. But Georgius, having heard or read the statement of Plutarch, already referred to, that once on a time the year had only 360 days, explained what his author had said of the abandonment of the old fixed year, in reference to a supposed abandonment of the imaginary year of 360 days; he added the words, "which before this was composed of only 360;" and, to make his meaning still clearer, he put the entire into other words, "he added the five additional days of the years." This may, or may not, be the source of the erroneous statement of Georgius; but that the statement is erroneous, I can entertain no doubt whatsoever. The continuance of the use of a year of 360 days to so late a date as about 1780 B. C. is far too improbable to be admitted on the testimony of a writer, so recent, and of such weak judgment, as Georgius Syncellus.

2. But it may be asked, might not a year of 365 days have been substituted for one of 360, at an earlier period than 1780 B. C., when the Egyptians were less civilized, and before they had intercourse with other nations? To a believer in the divine record respecting the peopling of Egypt, it might be sufficient to reply, that no such period of want of civilization and isolation from other nations, as this question presumes the existence of, can be supposed. When Ham and his descendants settled in Egypt, they came there fully acquainted with the knowledge that had been acquired before the flood; and we cannot doubt that the

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true length of the year was among the facts known. It is difficult to suppose that the excess of the solar year over 365 days should not have been known and estimated; but, as to its excess over 360 days being familiar to the first settlers, there cannot be a question. How then could it ever have occurred to them to limit the length of the year to 360 days? Even the unbeliever in revelation must see the absurdity of a year of 360 days having continued in use to so late a date as 1780 B. C.; but to the believer in the Holy Scriptures there is the same absurdity in the supposition that such a year ever existed in Egypt at all.

I write not, however, for believers in the Scriptures exclusively; and I will, therefore, without reference to their authority, reply to the question which I have supposed to be asked; and will show that a year of 365 days *could not* have been substituted for one of 360 days in the ages preceding 1780 B. C. any more than at that epoch.

The year 2782 B. C. has been fixed upon by some chronologers as that in which the year of 365 days succeeded that of 360. Those who maintain that opinion, or any similar one, will have to account for the hieroglyphical notation of the months on the different monuments. That notation could not have been introduced at the time when the year of 365 days was introduced, or at any subsequent epoch before about 1780 B. C., because until this last mentioned period the physical characters of the actual year could never have corresponded to the physical characters expressed by the notation. It remains then, that the notation must have been first introduced about 1780, *the form of the year remaining unaltered;* or that the notation must have been introduced previously to the change in the form of the year. The absurdity of the former supposition is shown in this manner. Assuming it to be the case, it must have been well known, at the time their denominations were given to the months, that they would become inapplicable to them in the course of a few years. There must have been many living, who would be able to testify, that, though the inundation commenced then at the beginning of the ninth month, it had commenced in their youthful days before the middle of the eighth, and they had heard from their fathers of its commencing in the seventh. There was no change in the form of the year cotemporary with the adoption of this notation of the months and seasons, which might give rise to the belief that *hereafter* the seasons would continue correctly denominated. The year must have been generally recognized

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as being in its nature a wandering one,—as having been so, and as still to continue so; and, this being the case, it seems hard to conceive how any legislator would think of giving names to the seasons of the wandering year, grounded on their coincidence with the seasons of a fixed year; and it is still harder to conceive how the names given by such a legislator should have supplanted those previously in use, and become the only ones, by which time was hieroglyphically described for above 2000 years!

3. The next supposition which I have to refute is, that these hieroglyphical names were originally given to the months of a year of 360 days. In the first draught of this paper I had not thought it necessary to notice an hypothesis, which appeared so irrational as this; but I have since learned that M. Biot has adopted it; and respect to his talents induces me to notice his work. There does not appear to be any argument brought forward by M. Biot in support of this opinion. He assumes, as two incontrovertible propositions, that the Egyptians originally used a year of 360 days, and that their calendar was originally adapted to such a year; and all his ingenuity is employed in inventing for them cycles, which, if they had known and used them, would have obviated, in some measure, the inconveniences of the system which he ascribes to them. Now I have already shown, that there is no ancient testimony in support of the opinion that the Egyptians used a year of 360 days; and as for the form of the calendar being an evidence of it, M. Biot might have recollected that the *Sanscullotides* were an original and essential part of the year, which his countrymen adopted at the Revolution, and which was precisely similar in its construction to the Egyptian year. There is not a shadow of evidence opposed to the opinion, that the "five celestial days" were, in like manner, an original and essential part of the hieroglyphic calendar. M. Biot has stated, that "in the first ages of a nascent civilization a year of 360 days, divided as in Egypt, would express the annual series of operations of agriculture with a fidélity which should have been *long* sufficient (qui a dû *long-temps* suffire)." In reply to this, I will only observe, that, in the short space of thirteen years, during which the French revolutionary calendar continued in use, if the sanscullotides had been omitted, the commencement of the year, and of course that of each of the months, would have deviated sixty-eight days from its original place; the vintage would scarcely be over when *Nivôse* would commence, and the snow might be still on the ground in the

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beginning of *Germinal*. I can conceive it to be possible that the French Revolutionists might have adopted a year of this form; but, had they done so, I cannot think they would have given *names* to the months, *expressive of their physical characters*;—not even though they had a Delalande to point out to them that "in sixty-nine or seventy years, or more accurately three times in 209 years, the months would return to their *normal* places." It is surprising to me that M. Biot did not perceive that the establishment of any cyclical relation between the year of 360 days and the tropical year supposes a knowledge of the length of the latter. Had the use of the tropical year preceded that of the year of 360 days, such a relation might have existed; but this is not M. Biot's opinion. He attributes the use of the year of 360 days to ignorance. It originated, according to him, in "the first ages of nascent civilization," ages of which I deny the existence in Egypt; and was abandoned when it was discovered that a year of 365 days would more accurately exhibit the succession of the seasons. Under such circumstances, how could a cycle, such as M. Biot has imagined, have been employed? The demi-savages, whom he supposes to have then inhabited the valley of the Nile, had not *him* to reveal it to them. In truth, the parts of M. Biot's memoir, in which he treats of the cyclical relations of this year of 360 days, are but a specimen of ingenious trifling. Till he had brought forward some proof that it existed at all, and, if so, that it existed cotemporaneously with the hieroglyphic notation of the months, he need not have troubled himself to show that in 209 years such a wandering year would have its seasons three times in coincidence with their primitive places; while in 487 years the dogstar would seven times rise heliacally at its commencement.

4. There is a fourth way of accounting for the hieroglyphic notation of the months, as it exists on the monuments. The notation might have been introduced, with or without a change in the form of the year, at the chronological epoch, similar to that of the eighteenth century before our era, which might have occurred in the thirty-third century before it. To this I reply, that the epoch in question is prior to the most remote of the eras which biblical chronologers have assigned for the deluge. This simple statement ought to be conclusive against the hypothesis. But, as this paper may fall into the hands of some who undervalue this consideration, I will lay before them some others.

I might appeal to the fact, that no dated inscriptions have been discovered,

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which even Champollion, who was disposed to give the highest possible antiquity to them all, could refer to an earlier age than the twenty-first century before our era. Is it probable that the hieroglyphic calendar should have been in use for twelve centuries before that time, and that no monumental records of its existence should remain? But I will rather apply myself to expose the fallacy of the grand argument, by which they, who throw back the origin of the hieroglyphic calendar to 3285 B. C., or before it, pretend to establish their system.

This argument may be briefly stated as follows. There is reason to think, from certain passages in ancient authors, that the summer solstice and the heliacal rising of Sirius coincided at the time when the hieroglyphic calendar was constructed. M. Biot alleges that this coincidence took place in the year 3285 B. C.; and, though he admits that it would continue *sensibly*, or within the limits of errors of observation, for 500 years on either side of this epoch, that is, from 3785 to 2785, he seems to think we are tied down to the middle date by the consideration that *then only* the two coincident phenomena would occur at the beginning of the ninth month of the wandering year. Now I admit that it is *probable*, though it is by no means certain, that there was a *sensible* coincidence between the summer solstice, the heliacal rising of Sirius, and the 241st day of the Egyptian year, when the hieroglyphic notation was introduced; but I say that this coincidence might have occurred more than 1000 years after the epoch, which M. Biot has assigned for it, *and subsequent to the biblical epoch of the colonization of Egypt.*

In order to prove this, I chiefly insist on the points, that what is called the heliacal rising of a star depends on two uncertain elements, namely, the latitude of the place of observation, and the depression of the sun below the horizon at the time of the star's rising, which is barely sufficient to allow that star to be seen;* that M. Biot has assumed greater values for both these elements than he

* In order to determine the heliacal rising of a star, spherical trigonometry furnishes us with the following formulas: α being the latitude of the place of observation; γ the depression of the sun below the horizon necessary for the star's being seen at its rising; λ being the declination, and μ the right ascension of the star, and ω being the obliquity of the ecliptic; we have, the latitude being north, and the declination of Sirius south;

$$\tan.\ \alpha.\ \tan.\ \lambda = \sin.\ \gamma;$$

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was in fairness entitled to do; and that, if he had not done so, the epoch of coincidence between the heliacal rising of Sirius and the solstice would have resulted much later than he makes it. It is, however, not unworthy of being noticed, that the *rigorous* coincidence, which he alleges to have taken place in the year 3285 B. C., and on which he appears to lay so much stress, did not really, *even on his own hypothesis*, take place in that year. The following are the solstitial dates in that year and in the two preceding and two following years, given proleptically, both according to the Julian computation and to that of the Egyptian wandering year. That for 3285 is taken from M. Biot's memoir, adding 1.93 hour for the difference between Parisian and Memphitic time; the others are deduced from this by addition and subtraction of 365 days 5.82 hours, which was in that age about the average interval between successive summer solstices.

Years B. C.			Hours after Memphitic Midnight.
3287	July 21st	Pachon 1st	10.92
3286	—— 21st	——— 1st	16.74
3285	—— 20th	——— 1st	22.56
3284	—— 21st	——— 2nd	4.38
3283	—— 21st	——— 2nd	10.20

$\mu + \nu$ being the arc of the equator between the first point of Aries and the horizon, at the time when Sirius is rising;

$$\frac{\cos.\omega.\cos.(\mu+\nu) - \sin.\omega.\tan.\alpha}{\sin.(\mu+\nu)} = \cot.\vartheta_0;$$

ϑ_0 being the arc of the ecliptic between the first point of Aries and the horizon;

$$\frac{\sin.\gamma.\sin.\vartheta_0}{\cos.\alpha.\sin.(\mu+\nu)} = \sin(\vartheta_\gamma - \vartheta_0;)$$

ϑ_γ being the arc of the ecliptic between the first point of Aries and a parallel of altitude, the vertical depression of which below the horizon is γ.

The morning, on which the sun's longitude *first exceeds* ϑ_γ, is the morning on which Sirius is said to *rise heliacally*.

Now ϑ_γ is, as we have seen, a function of five quantities, α, γ, λ, μ, and ω. The three last are determined, the time being given; but they vary with the time of observation. The two former are independent of the time; but α is different for different places of observation, and γ for different stars. The more brilliant the star, and the more remote its place of rising from the part of the horizon which is over the sun, the less will γ be.

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It appears from inspection of this table, in the first place, that the year 3285 B. C. ought not to have been selected as the year of coincidence between the solstice and the first day of Pachon, but rather 3287 or 3286. It appears also that about this period the summer solstice fell regularly on the 21st of July of the proleptic Julian year, and was only beginning to fall on the 20th in leap years. M. Biot, instead of *directly* determining the coincidence of the solstice and the heliacal rising of Sirius, which would be a purely mathematical problem, independent of any artificial divisions of time,* uses the 20th of July of the

* From the definition of heliacal rising, the sun's longitude at the time of the star's rising must exceed ϑ_γ, but by a less quantity than the space which it passes over in a day. Its average excess over it in a period of four years may be estimated at half this space, say 29′. 30″. Consequently, when the heliacal rising coincides with the solstice, ϑ_γ must be equal to the difference between 90° and this last-mentioned quantity, or to 89°. 30′. 30″. If λ, μ, and ω be calculated for any epoch, their values for other years may be expressed by series of the form $A_0 + A_1 t + A_2 t^2$, &c., t being the number of years after the epoch; and by the formulas of the preceding note, $\mu + \nu$, ϑ_0, and, ultimately, ϑ_γ may be expressed in similar series. The value of t, which will satisfy the equation $\vartheta_\gamma = 89°. 30'. 30''$, will give the precise number of years after the assumed epoch, at which the required coincidence took place. In order to simplify the calculation, the epoch for which λ, μ, and ω are calculated should not be far removed from the epoch of coincidence. In that case, we may confine ourselves to the terms in the above series which are independent of t, or contain only its first power. These terms will at any rate give a first approximation; and we may then calculate the values of λ, μ, and ω for the year so found as a new epoch. The great practical difficulty arises from the uncertainty which there is as to the proper motion of Sirius, and as to the precession, and change of the obliquity of the ecliptic. According to the best data that I have been able to procure, (namely, the values of the precession and obliquity given by M. Biot from Laplace's formulas, and the proper motion given in the catalogue of the stars in the Encyclopædia Metropolitana,) I make the right ascension of Sirius in 3285 B. C. to have been 43°. 47′. 15″, and his declination 23°. 37′. 45″. The former was increasing at the rate of 38″,43 a year, the latter diminishing at the rate of 13″,64 a year. The obliquity was 24°. 6′. 30″, and its diminution annually 0″,33. Substituting these values for λ, μ, and ω in the formulas of the preceding note, and making $\alpha = 30°$ and $\gamma = 11°$ (the values assumed by M. Biot) I find

$$\mu + \nu = 58°. 25'. 6'' + 28'',45\, t;$$
$$\vartheta_0 = 74°. 7'. 43'' + 28'',36\, t;$$
$$\vartheta_\gamma = 88°. 32'. 1'' + 25'',95\, t.$$

In these expressions, the rates of increase are much more to be depended on for accuracy than the values at the epoch.

From the equation

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Julian year as a middle term. The heliacal rising, he alleges, *always* occurred on that day; the solstice occurred on that day in 3285 B. C. In that year, therefore, they rigorously coincided. This appears plausible; but I would ask, in the first place, did the heliacal rising of Sirius occur *in every year* on the 20th of July? Would not the intercalation, which threw the solstice from the 21st to the 20th, have thrown the heliacal rising from the 20th to the 19th? We are, perhaps, not in a state to answer these questions, either affirmatively or negatively, from our ignorance of the precise amount of the change that the position of Sirius has undergone, in the long interval of 5000 years, from its own proper motion and from the precession of the equinoxes.* But, secondly, admitting that the rising of Sirius on the 20th July was the heliacal rising, was this the rising that coincided with the solstice? Is it not obvious, on the contrary, that the rising in the early morning of the 21st was the rising which coincided with an event that occurred at half-past ten in the preceding night? There was then no *real* coincidence between the heliacal rising of Sirius and the solstice in 3285 B. C. M. Biot must admit that there was none in the preceding or following years; and that which, he endeavours to show, took place in this year is only a colourable one, depending on the arbitrary commencement of the

$$88°.32'.1''+25'',95\,t=\vartheta_\gamma=89°.30'.30''$$

we have

$$25'',95\,t=58'.29'';$$
$$t=135.$$

If then the values of λ, μ, and ω that I have used be correct, the coincidence occurred in 3150 B. C.; or a few years earlier, as the coefficient of t^2 was positive, and the average rate of increase of ϑ_γ in 135 years was on this account somewhat greater than the rate at the commencement of the period. The coincidence would continue for as many years before and after this date as ϑ_γ would take to increase 29'.30'', or whatever was the exact value of the sun's motion in longitude for half a day. That is to say, it would continue from about 3215 B. C. to about 3085 B. C.

* If the value of ϑ_γ for 3285 B. C. be correct, the sun would have attained that longitude about thirty-six hours before the solstice; that is, about half-past ten in the morning of the 19th July. He would consequently have been some ten or eleven minutes less than 11° below the horizon at the time when Sirius rose. I should think this was within the limits of probable error in the computation. The occurrence of the heliacal rising of Sirius on the same day of the Julian calendar, which was the case for a great number of centuries, is owing to the excess of the mean Julian year, 365.25 days, over the tropical year, being very nearly equal to the time that the sun would take to pass over the annual increase of ϑ_γ.

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artificial day. It seems absurd to lay any stress on a coincidence occurring rigorously in any specified year, when the phenomena which coincide approach one another at the very slow rate of about eleven minutes a year, and when they would, of course, continue to coincide for about 130 years. But, as M. Biot has insisted a good deal on this coincidence having rigorously taken place in 3285 B. C., it seems proper to show that his statement to that effect is unfounded. The 130 years of coincidence did not begin till about seventy years after this epoch.

The error which M. Biot has committed in this matter is, however, comparatively of little importance. I now proceed to show that the suppositions which he has made in his calculation respecting the latitude and the arc of depression are altogether unwarranted. The former he assumes to be 30°, and the latter 11°. Now I contend that both of these values have been taken unwarrantably great; and the extent to which this vitiates the calculation may be judged from the following statement; a diminution either of the arc of depression or of the latitude by one degree will bring down the epoch of coincidence above 150 years.* A person aware of these facts might easily exhibit an apparent coincidence between the phenomena in question on any assigned year of perhaps 1500. He has only in the first instance to choose a suitable arc of depression; then to calculate under what parallel of latitude, *assuming this arc*, the star would rise heliacally at the solstice of the assigned year; and lastly, to invent plausible reasons for using that arc, and for placing his observer under that parallel. It appears to me that this is just the course which M. Biot has pursued. His curious reason for choosing the latitude of 30° seems to prove it. He takes the latitude of Memphis; "because for epochs so ancient we cannot place the centre of religion *in the very lowest parts of Egypt*." This *one-sided* reason shows plainly what was passing in his mind.

* Using the values of λ, μ, and ϖ for 3285 B. C., as laid down in a former note, I find that a substitution of 10° for γ, in place of 11°, diminishes θ_γ by 1°. 19′. 11″; a substitution of 29° for α, in place of 30°, diminishes θ_γ by nearly the same quantity, namely, by 1°. 20′. 11″. To compensate for this diminution, θ_γ must be augmented by the terms depending on the time; and, allowing for the increase which the coefficient of t would undergo, as well as for the necessary introduction of the term containing t^2, it will appear that either of these substitutions must bring down the epoch of coincidence considerably above 150 years.

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He would gladly have reduced the arc of depression, which he must have seen to be too great, by a couple of degrees; but had he done so, he must, by way of counterpoise, have added as many degrees to the latitude, and thus descended to the extremity of Egypt, which he could not venture to do. But why place "the centre of religion" so low down the Nile as Memphis? For doing so he has not assigned the shadow of a reason. If we are to seek the cradle of the Egyptian religion, and view the heavens from thence, tradition refers us not to Memphis or Heliopolis, but to Philæ, the reputed burial place of Osiris, and the most sacred spot in the country. I will not be so unreasonable, however, as to take M. Biot to the most southern part of Egypt. I propose that we divide the interval, and take Thebes for our observatory. It was the most ancient capital of Egypt, as all are agreed. The latitude of Thebes is 25°. 45′, four degrees and a quarter south of M. Biot's parallel, answering to about 600 years, by which I contend that I am entitled to bring down the epoch of coincidence between the solstice and the heliacal rising of Sirius. I have, in fact, calculated the solstice and the *Theban* heliacal rising for the year 2550 B. C., using, as M. Biot has done, 11° for the arc of depression; and I find that they took place on the same day, in that and many following years.*

But in making this calculation I erred by taking so large an arc of depression as 11°. M. Biot's reason for taking it is, that it was the value of that arc adopted by Ptolemy. I grant it; but this seems to me a sufficient reason for rejecting it as excessive. Ptolemy gives it as the arc of depression of the sun below the horizon, which would allow *a star* to be visible at its rising. He uses it for all stars alike, taking no notice of the inequality in this arc, which their unequal brilliancy and the unequal distance of their places of rising from the part of the horizon over the sun would require. Now, I argue, that, if 11° be the proper

* In 2550 B. C. I find, using the same data as before, $\lambda = 20°.\,51'.\,40''$; $\mu = 52°.\,16'.\,0''$; $\omega = 24°.\,2'.\,8''$; whence we have, for the latitude of 30°, $\theta_0 = 80°.\,31'.\,48''$; $\theta_{11} = 94°.\,24'.\,25''$; but for the latitude of Thebes, (25°. 45′) $\theta_0 = 76°.\,6'.\,12''$; $\theta_{11} = 89°.\,27'.\,52''$. This year, then, was about the middle one of those in which the solstice coincided with the heliacal rising of Sirius at Thebes; that is to say, on M. Biot's assumption that the arc of depression should be taken so great as 11°. I cannot but think that 9° or 9°. 30′ would be fully sufficient. Now I find that in 2550 B. C., at Thebes, $\theta_0 = 87°.\,1'.\,29''$; $\theta_{0.1} = 87°.\,38'.\,2''$. Subtracting these quantities from 89°. 30′. 30″, and dividing the remainders by 27″, we have in the former case 330 years, and in the latter case 250 years, as the intervals between 2550 B. C. and the mean epochs of coincidence.

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arc of depression for a star of average brilliancy, it is quite too great for a star of such preeminent brilliancy as Sirius; especially when the distance in azimuth of its place of rising from the sun was upwards of 60°. M. Biot allows that the observation of heliacal risings admits an uncertainty of three or four days at least; but one principal cause of this uncertainty is, that the heliacal risings of bright stars must precede, while those of faint ones must follow, the times calculated on the hypothesis of their rays having a uniform power. On the ground of the possible errors of observation, he allows 500 years *before* or *after* the epoch of 3285 B. C., as limits, within which the heliacal rising would sensibly coincide with the solstice. It appears to me, that there would be little likelihood of the heliacal rising of Sirius being *later* than the time calculated on the supposition of the sun's being 11° below the horizon, but that there would be every probability of its being *earlier*. It would, therefore, I contend, be right to lower the epoch on this account by *at least half* of this admissible error of 500 years. I have further to add, that there is a different source of errors of observation, which M. Biot has overlooked, but which should evidently be taken into account. He has only considered the possibility of erroneously observing the heliacal rising of Sirius; but, surely, an error in observing the solstice is to be expected also. He seems to have forgotten, that, in the whole of this argument, what has been called the solstice is not the observed arrival of the sun at the tropic of Cancer, but the observed commencement of the inundation of the Nile. In this observation an error of four or five days might easily take place, which would correspond to 520 or 650 years in the epoch. For this admissible error of observation, and for that which may remain in observing the heliacal rising, I conceive that 600 years will be a very moderate allowance. To sum up the whole of this argument, I take from M. Biot's epoch 135 years, in which I conceive that he has erred as to the epoch of coincidence between the solstice and the heliacal rising of Sirius, even on his own hypothesis as to latitude and depression. I take 600 years more, in which he has erred by taking the heliacal rising at Memphis in place of that at Thebes; and 250 years more, which he should have allowed for the superior brilliancy of Sirius to the average brilliancy of the stars mentioned by Ptolemy in his Apparitions. This reduces the epoch of *accurate* coincidence between the heliacal rising of Sirius and the solstice from 3285 B. C. to 2300 B. C.; and I maintain that there would be a *sensible* coincidence, within the limits of errors of observation,

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for 600 years before and after this last epoch; that is, to so late a date (at Thebes) as 1700 B. C. M. Biot, however, lays great stress on there having been a *treble* coincidence in the year 3285. Not only the heliacal rising of Sirius, *as computed by him*, and the solstice, but also the first day of the ninth month of the year, coincided in that year; and, whatever be the case as to the solstice and the heliacal rising of Sirius, he thinks that the solstice and the commencement of the ninth month could never have coincided between 3285 and 1780. Now, I admit that there is great apparent force in this reasoning, and it would be difficult to answer it on any other hypothesis as to the nature of the year than that which I am maintaining in this proposition. According to *this* hypothesis, however, *the objection does not lie*. According to it, there was *invariably* a sensible coincidence between the solstice and the beginning of the ninth month, from the first colonization of Egypt down to the beginning of the eighteenth century before Christ. And there was, consequently, by what I have just proved, a sensible coincidence between *all the three events*, not for a few years only, as M. Biot supposes, but for the whole period between the peopling of the country, and the change of the form of the year in the eighteenth century before our era.

5. I will now proceed to develope this hypothesis of my own, for which I have cleared the way by assigning special reasons why every other possible hypothesis should be rejected. Let me first, however, mention one grand objection, to which they are all in common liable. They none of them account in a satisfactory manner for the hold which the hieroglyphical notation of the seasons gained on the affections of the people. A wandering year existed in the country for 2000 years, the names of the months and seasons of which were descriptive of their physical characters at a particular epoch. If we say that the names were first given at that particular epoch, we in some measure account for their first introduction; we account for *these* names having been given rather than any other names descriptive of physical characters. All the hypotheses that we have been considering go *thus far*; but this is not enough; and they none of them go further. They do not account for names descriptive of physical characters being given to the months of a wandering year, rather than names expressing simply the order of succession, or names derived from the deities, which were supposed to preside over them. It is a remarkable fact, that names of this latter kind *existed*, and *might have been used*, but that *they never are used in*

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expressing dates. The month Athur *might have been expressed* in a date by the known symbol of the goddess of that name, who presided over it; namely, a hawk within an enclosure; but it *always is expressed* by a much more complicated group of hieroglyphics, signifying "the third month of vegetation." Now, on any of the hypotheses which we have been considering, except the first, it is a strange and unaccountable circumstance, that names of this last kind (names expressive of physical character) should have been given to the months *at all;* and on any of the hypotheses, the first inclusive, it is unaccountable how they continued in use, after they were found not to represent correctly the physical characters which they professed to represent. There is, it appears to me, only one way, in which this most remarkable fact can be accounted for. The names were first applied to the months of a *fixed year;* they continued to be applied to the months of such a year, until the use of them was firmly established by custom; and, when a wandering year was substituted for the old fixed one, the deviation was gradual; there was no violent change, sufficient to overcome the force of habit, which would plead powerfully for the retention of the old names.

But, it will be asked, how can we suppose it possible that the Egyptians, if they had ever enjoyed the advantage of having a fixed year, would abandon it, and adopt the less perfect year of 365 days in place of the more perfect one? To this I reply, that the Egyptians had a different notion of what a year ought to be from what we have; and that we have no right to question their having acted in a particular manner, merely because, if *we, with our present feelings,* had been in their situation, we should have acted otherwise. I conceive that, according to Egyptian notions, the year of 365 days, as it existed in the age of the Ptolemies, and for fourteen or fifteen centuries previously, was the perfect model of what a year ought to be; that the change, which introduced it in place of the old fixed year, would be considered as a grand reformation of the calendar; and that the getting rid of the 366th day, which had previously occurred at the end of certain years, would be regarded as the getting rid of an abominable nuisance.

This is not a mere conjecture of my own; the testimony of antiquity decidedly favours this opinion. Geminus, the most ancient writer extant, who alludes to the form of the year, further than simply to describe it, says that "it possessed a great advantage in the estimation of the Egyptians, in that it sancti-

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fied all the seasons equally, by bringing to them in their turn all the feasts of the year." The kings of Egypt were required to swear at their accession "that they would allow no intercalation of month or day, but would adhere to the 365 days, as their ancestors had appointed;"—a plain evidence of what I have somewhere seen stated as a fact, that some Egyptian king had attempted to restore the year to its original state by intercalating a month to make up for the days already lost, and by ordering single days to be intercalated afterwards on the old system; but that a popular insurrection had compelled him to abandon the project. The oath, it would seem, was imposed upon him at that time; and his successors were regularly required to take it. We have again a valuable testimony to the importance, which the Egyptians attributed to the preservation of the proper form of the year, in the complaint made by Iamblichus, after the fixed year had been substituted for the wandering one at the Roman conquest. "The change," he says, "has taken away all their force from the prayers of the people." If, in fact, we consider the religious appropriation of the days of the year to the different deities, we shall see the ground of this complaint. The year consisted of twelve months, and each month of thirty days. Now, these thirty days were parcelled out among the different deities, so that each had his own festival day occurring twelve times in the year. Each city, and probably each family and individual, had its peculiar days to be observed, while the remaining days in the month were passed over without notice. Besides these monthly festivals, there was a grand annual festival, observed on the five celestial days, in which all the Egyptians took a part. The honors paid to the kings, who were worshipped as gods during their lives, were arranged on this same system. We have a specimen in the decree on the Rosetta stone. The days, which were to be kept in honor of the young king, were *two in each month*, the 17th and 30th, because, as the decree states, the 30th Mesore was his birth-day, and the 17th Mechir was the day of his accession, and a yearly feast of *five days*, at the beginning of every Thoth, a feast equalling in length and immediately following the grand feast of the five celestial days. There is no reason to suppose that the honors appointed to be paid to Ptolemy Epiphanes by this decree were at all different from those which had been paid to his predecessors. Knowing, then, what these were from this valuable record, we obtain an insight into the whole system. We see the course of the monthly festivals; and we see how

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the introduction of a 366th day into any year would not only leave a day in that year without any religious rites properly belonging to it, but would throw all the religious rites of subsequent years from those days to which they would be popularly regarded as pertaining of right. Enough, however, has been said on this subject, which is rather a matter of curiosity than of importance. I proceed to explain the nature of the Egyptian year, which was first used, and to which the hieroglyphic notation was originally adapted, more fully than I have yet done.

The commencement of the year was originally fixed, and continued for many centuries, at the period when the fall of the Nile allowed the first operations of agriculture to commence. This may have been ascertained in the first instance by some kind of nilometer, which would mark the time when the Nile in its descent reached some standard height. It is not necessary to suppose that the year consisted, at the first introduction of this system, of months of thirty days, with additional days in the end. The division into three seasons probably preceded the division into months; and I think there is reason to suppose that these seasons were equal; or rather that two of them, probably the first and third, contained 122 days each, while the middle one contained 121 in ordinary years, and in what we should call leap years 122. My reason for this conjecture is, that in the final result, to which my researches have conducted me, I find the solstice to have occurred on the 244th, and not on the 241st day of the year. This might have been occasioned by an inaccurate observation, i. e. a late inundation, in the year, which happened to be selected as the standard one; but it appears more probable that the three seasons were for a time as nearly as possible of the same length; and consequently that the solstice was properly placed on the 244th day of the year, that being the first day of the third of the seasons. The determination of the commencement of the year by a nilometer was objectionable, as it would not give years of the same length. A year so determined might perhaps contain 370 days, or it might contain no more than 360; but, *on an average*, it is evident that the length of such a year must have been that of the true solar or tropical year. To avoid this inconvenience, another mode of determining the first day of the year was adopted, probably at a very remote period, very little subsequent to the colonization of Egypt. This method consisted in observing the meridian shadow cast by the sun on the first day of the year. The length of that shadow was measured in *some one year* on its first day, determined either

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by the nilometer, or by its being the 122nd after the solstice, and that length was thenceforward considered as the standard; and the day, in which the shadow, in its increase after the summer solstice, attained to that standard length, was accounted the first day of the new year. The years so determined would be of the same average length as before, but they could only consist of 365 and 366 days. They would arrange themselves in periods, consisting of three common and one protracted year, occasionally interrupted by periods consisting of four common and one protracted year. During the time that this system continued in use, and probably shortly after its introduction, the year was divided into twelve equal months of thirty days, and the five or six days, which it contained additional, were placed together at the end. To this form of year the hieroglyphical notation was adapted. The names given to the months in that notation expressed physical characters, which they were known to possess, and which they must continue to possess so long as the form of the year should remain as it was. In order to determine the first day of the year by the meridian shadow cast by the sun, it was necessary that there should be some object of a remarkable appearance, terminating in a point, and of a permanent nature, the shadow of which might be measured. The pyramids possessed all these characters in a remarkable degree; and I cannot doubt, that, whatever end they might be intended to answer of a sepulchral or religious nature, they were constructed externally with a view to their being used to mark the commencement of the year, and that they were actually used for this purpose. The ingenious author of the articles on the Pyramids in Fraser's Magazine, conceives that they were designed to mark the commencement of the wandering year at the period of their erection; the day of the pyramid's first casting a shadow being the day corresponding to the first day of the wandering year at the time when the pyramid was built. But in the long course of time, which must have elapsed while a pyramid was being built, the sun's altitude on the first of Thoth must have varied considerably, supposing, as this writer does, that the year was then a wandering one. Besides, the commencement of the building of a pyramid does not appear to have been an event of such importance as that its era should have been marked in this manner. I should think it much more likely that the pyramid was constructed so as that the first day of its casting a shadow at noon should be the first day of *a fixed year*; and there appears some reason to think that, in

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some of the pyramids at least, this was the case. It is a remarkable fact, that the date assigned by this writer for the erection of the great pyramid of Jizeh is the identical year of the epoch, at which I have been led to place the reformation of the Egyptian calendar; he calculates that it would cast its first shadow on the first of Thoth in 1767; and that is *the very year*, to which the cycle that I have discovered conducts me from A. D. 34; and in which, consequently, the length of the shadow at noon was sensibly the same as in *every preceding year*. This is a curious coincidence; and I should lay a good deal of stress on it, if I could depend on the inclination assigned to the pyramid by this writer being correct. It would appear from the measurement of the French engineers that it was more considerable; and that of the second pyramid, of which the top is in a finished state, is certainly so. It is not to be supposed that all the pyramids in a group were constructed for being used as chronometers. A single one would alone be required for this purpose, and the second pyramid at Jizeh was probably the one used. This would cast a shadow on the first day of the year, reaching to a perpendicular wall of rock, parallel to the north side of the pyramid. On this wall there are said to be hieroglyphics. It would be desirable that travellers in Egypt should ascertain if this be the case, and especially if the rocky wall be marked, opposite to the vertex of the pyramid, in any such manner as might constitute a sort of dial.

We must not suppose that the Egyptians waited for the construction of a pyramid in order to determine the commencement of their year, nor is it likely that there was any in existence so early. They used such a pointed object as they could readily procure; fixing upon some one object, and some one length of its shadow, as standards. The standard of measurement was easily *copied*. It was only necessary to have a suitable object previously prepared, and on the first day of the year, as indicated by the original standard, to mark the length of the shadow of that object. In this manner the standard of measurement might be transferred from one place to another; and at length such gigantic objects as the pyramids were every where used. But this led to an inconvenience, which was probably a principal cause of the wandering year being substituted for the fixed one. The indications of these standards would not always agree; and the longer the measure used, and therefore, apparently, the more accurate the measurement, the more distinguishable would be the dif-

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ference of the indications. The cause of this diversity may be easily seen. At the end of 365 days, the altitude of the sun would not be precisely the same as at the beginning, but about 5′ greater, his altitude decreasing something more than 20′ a day. If the standard were copied on the first day of this next year, the length of the shadow would evidently be, as compared with the original standard, too small, in the proportion of the cotangent of the altitude, increased by these five minutes, to the cotangent of the altitude itself. The consequence would obviously be, that the new standard would indicate a different series of years of 366 days from the original standard; it would point out the same first of Thoth in three out of four years, but one a day earlier in the fourth. To obviate this error, it would probably be soon agreed, that the standards should only be copied at the end of the years of 366 days, when the altitude would be nearly the same as at first. But this would only diminish the evil. In the first place, it could not in every instance be certainly known before-hand, whether the current year would consist of 366 days; it might be a matter of doubt, until the shadow decided the question, whether such a protracted year would, on this particular occasion, occur at the end of three or of four common years. But, setting aside this consideration, the copy taken at the end of a year of 366 days could never *perfectly* represent the original standard. The altitude at the end of four years would be somewhat different from what it was at the beginning; and though the copy then taken would agree with its original in indicating the *first* few years of 366 days, it would before long indicate different ones, its quinquennial periods being interspersed among the quadrennial ones in a different manner.

Under these circumstances, we cannot wonder that the Egyptians should consider the existence of these years of 366 days as a nuisance, and should in course of time determine to get rid of it. Had they occurred at settled intervals, they might have been tolerated; but, occurring as they did irregularly, and the standards in different parts of the country indicating different times for their occurrence, they would be a constant source of annoyance and contention. It was at length resolved that there should be no more intercalation, but that the twelve months and the five celestial days should constitute the entire of the year. The period when this change took place is indicated by the names of the months, hieroglyphically given to those of the year when a fixed one, and

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retained through the influence of custom after it had become a wandering one. Those names indicate physical characters, which the months of the wandering year could only have between the limits 1800 and 1760 before our era. Within these limits the reformation of the calendar must have taken place; and it will be the object of the following researches to establish the precise year, in which the new system was introduced.

III. I have already intimated that I have been directed in this inquiry by a passage in Tacitus. It is the twenty-eighth chapter of the sixth book of his Annals; and before I go further, I shall give a translation of the material part of this chapter.

"In the consulship of Paullus Fabius and Lucius Vitellius, after a long course of ages a phœnix arrived in Egypt, and caused much conversation respecting it among the most learned, both of the natives and of the Greeks. I will state those facts, about which there is an agreement, as well as some others that are doubtful, but not undeserving of being known. Those who have described its appearance are agreed that it is consecrated to the sun, and in face and plumage unlike to other birds. Different accounts are given respecting the number of years that it lives. The most common statement is 500 years. Some say that the interval is 1461 years; and that former birds flew into the city of Heliopolis (attended by great numbers of other fowls, which were astonished at the strange appearance) first in the reign of Sesostris, afterwards in that of Amasis, and next in the reign of Ptolemy, the third Macedonian sovereign (Ptolemæo qui ex Macedonibus tertius regnavit). But the chronology is certainly obscure. Between Ptolemy and Tiberius were less than 250 years. On this account, some have supposed that this last was not a real phœnix; that it did not come from the land of Arabia, nor do any of those things which the old tradition has recorded." Then, after describing the manner in which the phœnix provides itself with a successor, he concludes: "These things are uncertain, and in part fabulous; but there is no doubt that this bird is sometimes seen in Egypt."*

* Paullo Fabio, L. Vitellio Coss. post longum sæculorum ambitum, avis phœnix in Ægyptum venit, præbuitque materiem doctissimis indigenarum et Græcorum, multa super eo miraculo disserendi: de quibus congruunt, et plura ambigua, sed cognitu non absurda, promere libet. Sacrum soli id animal, et ore ac distinctu pinnarum a ceteris avibus diversum, consentiunt qui formam ejus

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It is evident from this last sentence, that Tacitus, and those from whom he derived his information, were completely mystified by the Egyptian priests; and that they supposed the phœnix to be a real bird. Pliny appears to have thought the same. He speaks of it in his Natural History B. 10, c. 2; and, while he mentions 660 years as the length of its life, he preserves an important statement of Manilius, that "in the life of this bird a revolution of the Great Year was completed, and the seasons and stars returned to the same situations." Brotier, in his note on the above cited passage in Tacitus, after correcting an absurd mistake of Hardouin, who understood Manilius to speak of the paschal cycle of 532 years, gives it as his own opinion, that he spoke of the canicular cycle of 1461 years; after describing which, he says, "This is that most celebrated revolution of the Great Year, and restitution of the zodiac, *which was shadowed forth by a bird, sacred to the sun, and renewing its existence from itself; whence the Egyptian fable of the Phœnix originated.*" There can be no doubt in the minds of any, who are acquainted with Egyptian literature, that this idea of Brotier's is a correct one, and that *the appearance of a phœnix* was a mystical mode of expressing *the renewing of a cycle.* He had, however, no right to assume that the cycle spoken of by Manilius was the canicular cycle, or that the Egyptians used no other cycle than this. We learn from Censorinus, that that cycle was renewed A. D. 138; the phœnix whose life was 1461 years appeared at that time; but we learn from this passage of Tacitus that some phœnix made its appearance A. D. 34, which was the year in which Fabius and Vitellius were consuls. We learn also that this phœnix, or a different one, had previously appeared in the reigns of Sesostris, of Amasis, and of Ptolemy Phila-

definiere. De numero annorum varia traduntur: maxime vulgatum quingentorum spatium: sunt, qui asseverent, mille quadringentos sexaginta unum interjici; prioresque alites, Sesostride primum, post Amaside dominantibus, dein Ptolemæo, qui ex Macedonibus tertius regnavit, in civitatem, cui Heliopolis nomen advolavisse, multo ceterarum volucrum comitatu, novam faciem mirantium. Sed antiquitas quidem obscura; inter Ptolemæum ac Tiberium minus ducenti quinquaginta anni fuerunt; unde nonnulli falsum hunc phœnicem, neque Arabum e terris credidere, nihilque usurpavisse ex his, quæ vetus memoria firmavit: confecto quippe annorum numero, ubi mors propinquet, suis in terris struere nidum, eique vim genitalem affundere, ex qua fœtum oriri; et primum adulto curam sepeliendi patris; neque id temere, sed sublato myrrhæ pondere, tentatoque per longum iter, ubi par oneri, par meatui sit, subire patrium corpus, inque solis aram perferre atque adolere. Hæc incerta et fabulosis aucta. Ceterum aspici aliquando in Ægypto eam volucrem non ambigitur.

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delphus or Evergetes. The latter of the two was evidently the one of whom Tacitus was thinking, when he said that between Ptolemy and Tiberius there were less than 250 years; though this observation is incorrect, even in reference to Evergetes, unless we count from the end of his reign to the beginning of that of Tiberius. We should, however, recollect that Tacitus is here copying the words of some other writer, and that *he* may have considered Alexander as the first Macedonian sovereign of Egypt, though Tacitus overlooked him as such. The writer of the article in Fraser's Magazine conceives that apocatastatic cycles of 1460 years terminated at the several epochs, at which Tacitus places the appearance of a phœnix; and he thinks that *one* of those cycles commenced at the chronological epoch of the eighteenth century before Christ, and ended in the reign of Ptolemy Philadelphus. This might be readily admitted; but at what chronological epoch can we fix the commencement of that cycle, which terminated A. D. 34? or that, which terminated in the reign of Amasis; 1461 years before which, the year of 365 days was not in use, according to this gentleman's system, any more than according to that, which I have endeavoured to establish in opposition to it? Besides, Tacitus evidently intimates, by what he says of the interval between Ptolemy and Tiberius, that these appearances had been recorded by the author whom he follows, as a connected series, and not as a number of independent ones.

On these grounds, I concluded that a series of cycles, of some sort or other, must have terminated A. D. 34. The origin of them I could only fix at the reformation of the calendar in the eighteenth century before Christ; and what I had to do in order to ascertain their number, was merely, by comparing some one of the epochs mentioned by Tacitus with A. D. 34, to obtain such narrow limits for the length of the cycle, as that there could only be a single integral quotient, when this length should be made to divide the entire interval, which I had already restricted within the limits 1833 and 1793 years.

Of the three epochs which Tacitus mentions, the first was of no use to me, because even the age at which Sesostris lived is not among the *data* of chronology. Still less could the limits of his reign be so. The last was likewise insufficient for my purpose; for the possible limits, which it gives for the appearance of the phœnix, are 285 B. C., the beginning of the reign of Philadelphus, and 222 B. C., the end of the reign of Evergetes. The limits of the interval

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are consequently 318 and 255 years, which will allow of being repeated six or seven times between the chronological epoch and A. D. 34. The penultimate appearance, in the reign of Amasis, was, consequently, that, on which I had to depend. Amasis reigned 44 years, down to about half a year before the Persian conquest. No chronologer has fixed this conquest later than 525; which is, therefore, the latest date, at which this phœnix could have appeared. There are cogent reasons, however, for placing it two years earlier; and I am inclined to think that the first year of Amasis was that which began in January, 572, B. C.*

* As this does not appear to be recognized as a truth by the students of Egyptian literature, and as the arguments in its favour can be very briefly stated, it will be well to state them here. 1st, Manetho, as quoted by Africanus, makes the reign of Cambyses over Egypt *six* years. 2nd, There is an inscription in existence near Cosseir, (Burton's Excerpta Hieroglyphica, pl. 8,) in which the duration of the Persian authority in Egypt, up to the period of its being cut, appears to be recorded. The period stated is *six* years of Cambyses, thirty-six of Darius, and twelve of Xerxes. 3rd, There is a pillar in the museum at Florence, the inscription on which reckons seventy-one years from the 3rd of Neco to the 35th of Amasis; whence it follows that Neco and his successors reigned thirty-nine years before the accession of Amasis. Now, the first year of Neco could not have been later than 610 B. C., as we know from Scripture that in that year he defeated Josiah. Consequently, the first year of Amasis could not have been later than 571 B. C. As the first year of Darius was 521 B. C., we have at least fifty years for the interval, viz. forty-four for the reign of Amasis, and six for that of Cambyses and Smerdis. It is probable, however, that the first year of Neco was 611 B. C., and that of Amasis 572 B. C. We may allow a year for the short reign of the son of Amasis; for the confusion attending on the conquest, and for the dominion of the Magi; and there will then remain forty-four years for Amasis to have reigned, and six for Cambyses.

With respect to the division of the intervening thirty-nine years, I believe Herodotus to be correct when he assigns sixteen years to Neco, and six to Psamitich II: Manetho, as we find his text in Syncellus's work, on the authority of Africanus, makes the two reigns to contain six years each. This, however, is an obvious mistake of a copyist as to the reign of Neco. There remain seventeen years for Apries or Uavre, "the priest of the sun," reckoning his reign to last from the death of Psamitich II. to the accession of Amasis. As to the latter limit, however, it is probable that Uavre lived some time after Amasis assumed the royal dignity, say two years. This would account for his reign having been reckoned as of nineteen years by Manetho; and it may have been reckoned by others as of twenty-five years, (the number given to him by Herodotus,) if his years were computed from the death of Neco. I suppose Psamitich II. and Uavre to have been brothers, and to have shared the sovereignty between them. I suppose, further, that the king, known to us from the monuments as Psamitich III., was the son of Psamitich II., and that in course of time he was deposed by his uncle. Amasis married the daughter of this prince, and avenged his cause by

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I therefore take this as the earliest date. The least and greatest intervals are 558 and 605 years; halving which, I obtain 279 and 302½, as the least and greatest numbers of years that the cycle can contain. These limits are inconsistent with there being any number of cycles except *six* between the chronological epoch in the eighteenth century and A. D. 34. Five such cycles could not have exceeded 1512½ years, while seven could not have been less than 1953; but we have seen already that the entire interval could only vary about twenty years from its mean value 1813 years. It consequently became a matter of certainty that the number of cycles was *six;* and that the least possible value of each was 299 years, the sixth part of 1793. The greatest possible value has been previously determined to be 302½ years.

IV. The next point was to ascertain what period of time, having a cyclical character, and being such as the Egyptians would be likely to observe, was to be found within the narrow limits which have been now determined, 299 and 302½ years. I observe, in the first place, that *any* cycle, depending on a comparison of the wandering year of 365 days with a fixed year of any description, could not differ much from 1505 years, which is the nearest whole number to the quotient of 365 days by the excess of the mean tropical year over 365 days. It is evident then that the period which we wish to ascertain could not be any such cycle, *taken as a whole.* It might, however, be *a submultiple of it;* and it at once presents itself to us as a remarkable coincidence, that the only small divisor which 365 will admit, namely *five*, is the only integral quotient that could result from dividing a number which can but little differ from 1505 by a number lying between the limits 299 and 302½. We are not then driven to the necessity of seeking a lunisolar cycle, or a cycle connecting the revolution of the moon with the year of 365 days, which might lie between the prescribed limits; we at once

deposing Uavre; which, we know, he did by the aid of Nebuchadnezzar, king of Babylon, to whom he was in subjection for a considerable part of his reign.

The above appears to me the most probable mode of solving the acknowledged difficulties respecting the succession of the Saitic kings. I do not propose it as absolutely certain; but I cannot but regard it as what should be considered *a settled point*, that the conquest of Egypt took place in 527 or 528 B. C. I am aware of the confident statements of Herodotus and Diodorus to the contrary; but these are in my judgment far outweighed by the threefold evidence that I have adduced against them.

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see that the cycle required was that, in which *some annual phenomenon* advanced seventy-three complete days through the wandering year; that is to say, in which it traversed through a fifth part of it. Now what phenomenon was so likely to be chosen as that, which had marked the commencement of the old fixed year, and for observing which there existed every facility? The only other annual phenomena, which suggest themselves, as at all likely to have taken the place of this, are the heliacal rising of Sirius, and the solstice or commencement of the inundation. The former of these is, however, out of the question, because the corresponding cycle would contain only 1460 years; the fifth part of which, 292, is less than the minor limit already ascertained. In fact, if we counted back six periods of 292 years from A. D. 34, we should reach the year 1719 B. C., when the physical characters of the seasons would by no means correspond with accuracy to those indicated by their hieroglyphical names. The difficulty of observing the solstice correctly, on account of the very great altitude which the sun then has in Egypt, as well as on account of the small change which its altitude then undergoes on consecutive days, renders it exceedingly unlikely that that phenomenon should be chosen; and there would be no advantage gained by observing the commencement of the inundation, as there is a want of regularity in it. Taking all these circumstances into consideration, it cannot, I think, admit of a doubt that the interval between the introduction of the wandering year and A. D. 34 contained *six-fifths of a complete cycle*, in which the phenomenon, which had marked the commencement of the old fixed year, travelled through all the days of the wandering year.

V. It only remains that we should determine the length of this complete cycle. But here, methinks, some one will ask—"have you not yourself already stated it? Is not this the cycle obtained by comparing the year of 365 days with the mean tropical year, which you have already stated to be 1505 years?" I answer that the *mean tropical year* is a mathematical abstraction, which may be *calculated*, but which cannot be immediately *observed;* and that of the *many* tropical years which may be *observed* the inequality is so great, as sensibly to vary the length of the cycle formed by comparing them with a year of 365 days. There are two distinct causes for the tropical year, *as it must have been observed by the Egyptians*, differing from the *mean* tropical year; and both of these causes have the effect of lengthening the year, and consequently of shortening

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the cycle. They do this to such an extent, that 300 years will be found to be the true length of the smaller cycle, and not 301, as would be the case if we used the *mean* tropical year. The first of these causes is the annual change undergone by the equation of the centre, proper to the point in the orbit where the sun is situated at the commencement of the year. The sun's perigee passed through that point in the orbit about 400 years before the chronological epoch of the eighteenth century before Christ; whence it is easy to see that for a long course of ages about that epoch the sun would at the end of a mean tropical year be behind his place at the beginning of it; as the annual change in the equation of the centre would always lengthen the year.* The other cause of the year being

* Let θ be the sun's longitude at the commencement of any year, reckoned from the mean equinox of that time, and not corrected for lunar or planetary perturbations. Let θ' be the sun's longitude, reckoned in like manner, at the end of any time t. The elliptic theory of the planets gives us the following equations, n expressing the mean motion in longitude during that time in reference to the mean equinox;

$$\theta = \varepsilon + 2e\sin(\varepsilon - \varpi) + \&c. \qquad (1)$$

$$\theta' = nt + \varepsilon + 2e'\sin(nt + \varepsilon - \varpi') + \&c. \qquad (2)$$

The remaining terms of these values, containing the second and higher powers of the eccentricity, may be disregarded; as it is evident they can only modify in a very slight degree the results obtained from considering the two first terms. At the end of a tropical year

$$\theta' - \theta = 2\pi; \qquad (3)$$

and the value of t which satisfies this equation is, of course, the length of the tropical year. What is called the *mean* tropical year is the value of t, obtained by leaving out of consideration the part of the orbit in which the sun was situated at the beginning of the year; or, in other words, by considering only the *first* terms in the above values, which are independent of the angle $\varepsilon - \varpi$. In the mean tropical year, $\theta' - \theta = nt$; and therefore, by (3)

$$nt = 2\pi; \text{ or } t = \frac{2\pi}{n}. \qquad (4)$$

It is evident that this value of t would also satisfy (3), taking into consideration the other terms in the values of θ and θ'; provided only that e and ϖ were invariable. The divergency, then, of the various tropical years that may be observed from the mean tropical year is due to the secular variations of these elements. We know that e is continually diminishing, while ϖ is continually increasing. Let $e - \delta e$ and $\varpi + \delta\varpi$ express the values e' and ϖ', belonging to the end of the year; and let δt be the variation of the length of the tropical year, caused by the variations of the elements. It will obviously be a function of δe, $\delta\varpi$, and of the angle $\varepsilon - \varpi$; and it will depend on the magnitude of this angle (that is, on the part of the orbit where the sun is situated at the commencement of the year) whether it is to be added to the mean tropical year, or subtracted from it.

Substituting in (2) their values for e' and ϖ', and writing $t + \delta t$ for t; confining ourselves also

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lengthened is the diminution of the obliquity of the ecliptic. The phenomenon, by which the commencement of the year was indicated, was the attainment of a given length by the meridian shadow of an object; that is, the diminution of the sun's altitude beyond a given limit, or his attaining a given south declination. Now, the sun being at this time in the quadrant following the equinox, he must not only attain the same longitude as he had at the beginning of the year before this can happen, but he must go over a small additional arc sufficient to compensate for the decrease of obliquity. The time of his passing over this small arc must be added to the mean tropical year, as well as the time of his passing over the annual variation of the equation of the centre; and the sum of all three will be the tropical year, as it would have been observed by the Egyptians. I do not mean to say that it would be precisely so in a single year. The lunar and planetary perturbations might make it greater or less. But, taking the sum of a few observed years, the effect of these perturbations would disappear, and the average value of the observed year would be that which I have stated.

It remains that I should ascertain the numerical value of this tropical year. I find, in the first place, that the annual precession, about the time of the chro-

to the first powers of the variations, as well as of the eccentricity, we have by equation (3)

$$0 = n\delta t\{1 + 2e\cos(\varepsilon - \varpi)\} - 2\delta e\sin(\varepsilon - \varpi) - 2e\delta\varpi\cos(\varepsilon - \varpi);$$

$$\delta t = \frac{2\delta e\sin(\varepsilon - \varpi) + 2e\delta\varpi\cos(\varepsilon - \varpi)}{n}.$$

When the mean anomaly is less than 90°, both the terms, which compose the value of δt will be positive. It was so, in the case we are considering, from the earliest age that can be conceived to about the year 2170 B. C., when the perigee passed through the sun's place at the commencement of the Egyptian year. In the next quadrant, the term depending on δe is negative; but during the greater part of the time that the perigee takes to pass through it, δt will be positive, on account of the variation $\delta\varpi$ being greater than δe. If $\varepsilon - \varpi$ be greater than 180°, but less than 270°, δt will consist of two negative terms; and if it be less than 180°, but greater than 90°, its terms will be of opposite signs, but the negative one will preponderate.

In the interval between the chronological epochs of the eighteenth and third centuries before Christ, the average value of $\varepsilon - \varpi$ in reference to the summer solstice was about 218°. The tropical year commencing at that solstice was consequently less than the mean tropical year, both the terms of δt being negative; and of course the cycle, formed by comparing such a year with the year of 365 days, was greater than the cycle, formed by comparing the mean tropical year with the year of 365 days. The latter consisted of 1505 years; the former of 1508 years; the coincidence of the solstice with the 241st day of the year occurring in 1779 and 271 B. C.

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nological epoch in the eighteenth century before Christ, was, by Laplace's formula, 49″,32; that is, 0″,78 less than the precession, with which Delambre's tables are calculated. I seek then in those tables the time in which the sun would describe 360°. 0′. 0″,78, and find it to be 365,242485 days, which I take for the length of the mean tropical year. I find the annual variation of the equation of the centre to be 2″,1125, taking into account both the decrease of the mean anomaly and that of the eccentricity. The time of describing this arc would be 0,000595 of a day. Lastly, the annual decrease of the obliquity of the ecliptic is 0″,4238. This must be compensated for by an increase in the longitude of 0″,58845; and the sun would take 0,000166 of a day to describe this arc. Adding together these three quantities, we have for the value of the tropical year, *as the Egyptians would observe it*, but independent of lunar and planetary perturbations, 365,243246 days. I now divide 73 days by the excess of the last number over 365, and the quotient is 300,1077 years.* When we consider that this is the value of the cycle, calculated on the supposition that the length of the year at the beginning of the eighteenth century had always been its length; but that, in point of fact, its length had been for many previous centuries constantly decreasing, it will be obvious that the Egyptians, looking to their past observations, could not possibly have estimated the lesser cycle at more than 300 years. I have built nothing on the consideration of this being a round number, though that is a circumstance that would not be likely to be overlooked, even had 301 been a somewhat more accurate cycle; but I contend that, accord-

* There can be little doubt that Laplace's formulas give the obliquity and its annual variation in past ages too great, and the precession too small. In the question respecting the heliacal rising of Sirius, the correction of this error would have been in my favour. Here it is the reverse; and, therefore, candour obliges me to notice it, and to estimate its bearing on the strength of my argument. The difference between the precession now and in 1780 B. C., as estimated by Laplace, cannot have exceeded its true value by so much as 0″.06. The excess was probably much less; but I am now taking extreme values. The annual decrease of the obliquity must have been at the least 0″.39. The difference between this and the value in the text would be compensated for by a difference of 0″.047 in longitude. The total difference is less than 0″.107; over which the sun would move in 0.00003 of a day. We should thus have 0.243216 for a divisor, in place of that in the text; which would give 300.144 for the quotient, determining the length of the cycle. The difference between this and the value given in the text is evidently immaterial, so far as our present argument is concerned.

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ing to the principles laid down for computing the value of the tropical year, it is such as will lead to 300 and not 301 years, as the time in which the sun would descend to the standard altitude on the seventy-fourth day of a year made to consist always of 365 days.

Counting back six of these periods of 300 years from A. D. 34, I arrive at 1767 B. C., in which year the commencement of the wandering year was on the 8th November. On that day, therefore, the new system must have been adopted; and the first Egyptian year of 365 days must have been the one, of which that was the first day. The longitude of the sun on that day was about 211°. 39′; and its declination about 12°. 18′ south. We may therefore safely conclude that $12\frac{1}{4}^{\circ}$ was nearly the standard declination; and that up to this epoch (1767 B. C.) *the first day in which the sun's south declination exceeded* $12\frac{1}{4}^{\circ}$, *was the first day of the year*. I will only add, that the first day of the year, computed in this manner, will occur at the end of 300 years on the 109574th day from the introduction of the system; those 300 years containing 109573 days, or $300\frac{1}{3}$ Egyptian years of 365 days. And not only so, but this will continue to be the case for no less than ten periods of 300 years, or two complete revolutions of the seasons. I find that on the 19th October, A. D. 1234, which was 3002 years of 365 days from 8th November, 1767 B. C.; and which would have been the 1st Thoth of 3003rd Egyptian year, had such continued in use; the sun's declination was less than 12°. 35′; and consequently this was the first day of its exceeding 12°. 15′; for the diurnal increase of the declination was, at that time, and in that part of the orbit, near 21′. If we trace the period backward, in place of forward, its accuracy is considerably greater. In the 900 years preceding 1767 B. C. the change of declination would not amount to a minute; and in the preceding ages, if we choose to calculate what would have occurred before the colonization of Egypt, the cycle would be so exact, that the change of declination in 300 years would be scarcely observable.

VI. I now proceed to mention some important verifications of these results, which I have obtained from independent considerations, since I first arrived at them. These verifications respect first *the length of the cycle*, and secondly *the date of its epochs*.

1. It is a very remarkable circumstance, that the double period of 300 years, or the time in which the attainment of $12\frac{1}{4}^{\circ}$ south declination by the sun would pass from the first to the 147th day of the wandering year, is a lunisolar cycle of

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singular accuracy, being nearly equal to 7421 synodical revolutions of the moon. In fact, if we assume 600 tropical years to be equal to 219146 days; which in those remote ages was scarcely more than their true value, according to the Egyptian mode of observation; and if we equate this value to 7421 lunations; we obtain for the length of each lunation 29,53052 days. The true length of a lunation was in the 18th century before Christ about 29,53060 days; the error being only one 12500th part of a day in each lunation, or, more accurately, 5916 ten thousandth parts of a day in 600 years. There can be no doubt that the lunisolar cycle of 600 years was observed in the most remote antiquity.* The knowledge of it, acquired in antediluvian times, would be preserved by the survivors of the deluge; and would be carried at the subsequent dispersion to all countries. The Egyptians would thus have been led to pay particular attention to this period of 600 years; and, when they noticed the remarkable fact, that in the half of that period there occurred just 73 years with 366 days; and, consequently, that it would be equal to $300\frac{1}{2}$ years of 365 days; they would be the more easily persuaded to adopt a wandering year, which connected itself so readily with the cycle that was already in use among them. I here speak of the men of learning among them; for, as to the bulk of the population, all *their* feelings would be in favour of a year of uniform length, and in opposition to the nuisance of the 366th day, which, occurring so irregularly as it did, was a constant source of vexation to them. The period of 300 years was thus the half of the lunisolar cycle of 600 years, and at the same time the fifth part of the cycle of 1500 years, which commenced at the time that the year began to wander, and would terminate when the 1st of Thoth returned to its original place in respect to the seasons; when the sun would again attain to $12\frac{1}{4}^{\circ}$ south declination at its noon. Properly speaking, the period of 300 years was not *cyclical*. At the end of it, nothing returned to the situation in which it was at the beginning of it; but it was the greatest common measure of the two cycles which the Egyptians used, and consisted of an integral number of days; it thus possessed two characters, which entitled it to especial notice. Another period, also claiming especial notice, was the great period of 3000 years, which was the least common multiple

* It has been often remarked, that Josephus speaks of the cycle of 600 years as having been known to the antediluvians; accounting for their discovery of it by the great lengths of their lives. —See Ant. Jud. I. 3. 9.

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of the two cycles; containing five lunisolar cycles, and two cycles of 1500 years. This period of 3000 years is mentioned by Herodotus (Eut. 123) as that in which the transmigration of souls is completed; and it appears from the Old Chronicle to have been the duration of the reign of Chronus, or Time.

But an objection may here be stated. If the period of 300 years was not in strict propriety cyclical, why should the Egyptians have represented it by a phœnix, which could only symbolize a period, in which things returned to their pristine state? This objection admits the following answer; which, if it be correct, supplies a fresh verification of the results, at which I have already arrived. The Egyptians did not place the return of a phœnix at the end of *every* period of 300 years; but only when the multiplier was an even number or five. In other words, using their mystical language, no phœnix lived so short a time as 300 years; but as one phœnix lived 600 years, and the other 1500, the intervals between the successive appearances of phœnixes would *sometimes* be only 300 years. Now, it is to be observed, that, though the period of 300 years, which terminated A. D. 34, was the sixth such period, since the reformation of the calendar in 1767 B. C.; the phœnix which appeared then is only numbered by Tacitus as the *fourth*. Why? because at the end of the *first* and *third* periods of 300 years, there was no *complete revolution*, and consequently no *phœnix*. Tacitus's phœnixes appeared first under Sesostris. This was the lunisolar phœnix, whose life was 600 years, which is the space mentioned by Philostratus in the third book of his life of Apollonius. The time of its appearance was the 147th day of the 601st Egyptian year, or 4th November, 1167, B. C. The next phœnix, which Tacitus mentions, was of the same sort; and appeared under Amasis on the 293rd day of the 1201st Egyptian year, or 31st October, 567 B. C. This falls within the reign of Amasis according to any system of chronology; and, according to what I conceive to be the most probable system, it falls in his sixth year. The third phœnix of Tacitus was that of which Manilius speaks; saying, that "in its life a revolution of the great year was completed, and the seasons and stars returned to the same situations." Its life was accordingly 1500 years, and it returned, *alter et idem*, on the first day of the 1502nd Egyptian year, or on the 29th October, 267 B. C.; which was the 19th year of Ptolemy Philadelphus, the third Macedonian sovereign of Egypt. Lastly, the lunisolar phœnix appeared under Tiberius, on the 74th day of the 1802nd Egyptian year, or 27th October, A. D. 34. We have thus all the phœnixes, whose

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appearances are recorded by Tacitus, accounted for; and the only scruple, which any one can have, in respect to the coincidences of these appearances with the reigns of the kings whom Tacitus mentions, is whether Sesostris reigned at so late a date as 1167 B. C. I will not discuss this point. I will only observe that, according to Mr. Cullimore, who has paid much attention to Egyptian chronology, the construction of "the Memnonium," as the palace of this sovereign at Thebes has been most improperly called, took place about 1138 B. C.; and he reigned sixty-eight years, according to Manetho;* so that, if Mr. Cullimore be right, he might well have commenced his reign before 1167. I take it for granted, that we are to understand by Sesostris, Rameses the Great; the second sovereign of that name, whose numerous monuments exhibit him as the most distinguished of a race of conquerors.

2. I now come to some verifications of the epochs, that I have assigned for the commencements of these cycles. Connected as they are with one another, it is evident, that, if any *one* can be verified, independently of the series, the verification will extend to *all*. I at first considered the statement of Tacitus as so explicit with respect to the year 34 being that of the appearance of the phœnix, that I felt little desire for any verification of it, so soon as I became quite satisfied that the cycles of 600 and 1500 years were established on sure grounds. I was, however, startled at finding that the appearance of this phœnix was fixed by Pliny in a different year. He speaks of it (B. 10, ch. 2) as having arrived in Egypt in the consulship of Papinius and Plautius, that is, in A. D. 36. From the whole train of argument that I have used, it is evident that this change in the year of appearance of the phœnix, supposing it to be established, would only alter the epochs of my cycles, bringing them down two years, or 730 days;

* There is a tablet in the British Museum, dated on the 29th of the first month of the Inundation, (Pachon,) in the sixty-second year of this prince. Mr. Cullimore fixes the date of the Memnonium from the astronomical sculptures on its ceiling. It is but fair, however, to state, that from the very same data M. Biot places the building of this edifice in 1500 B. C., and Mr. Wilkinson in 1322 B. C. Though I feel disposed to agree with Mr. Cullimore, I by no means regard his system as established on perfectly sure grounds; nor do I consider my own conclusions, contained in this paper, to be so connected with it, as that they would be shaken by its being overturned. Tacitus may very well be supposed to have used the name "Sesostris" *indeterminately;* not for the great Rameses, but for some of the numerous princes who claimed descent from him, and bore his name. All, I presume, will admit that the sovereign who reigned in 1167 B. C. was a Rameses; and Tacitus may have meant nothing more than this.

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making, for example, the origin of the system to be the 7th of November, 1765 B. C., in place of the 8th November, 1767. Being desirous, however, of getting rid even of this small uncertainty, I considered, in the first place, whether Tacitus or Pliny was *a priori* most worthy of credit, as to his date of this phenomenon; and, in the second place, what confirmation there might be obtained of either date from independent sources.

As to the first point, it appears to me that an annalist, like Tacitus, recording the events that occurred in the period of which he treated in their regular order, would be much less likely to go astray than a writer, like Pliny, who merely recorded the date of an isolated fact. The confusion, which existed among the chronologers of that period, with respect to the correct epoch of the building of the city, might easily lead to an error of two years; for, though Pliny describes the year, in which the phœnix appeared, by its consuls, and not by the year of the city, the author from whom Pliny copied may have used this latter mode of describing the year; and Pliny may have used consular Fasti, constructed on a different system from those which his author used; e. g. the latter may have stated, that the phœnix appeared A. U. C. 787, which would coincide with the consulship of Fabius and Vitellius, according to the chronology of Varro, or with A. D. 34; but Pliny may have understood him as speaking according to the chronological system of Cato, in which A. U. C. 787 coincides with the consulship of Papinius and Plautius, or A. D. 36.* Now, that this is the true mode of accounting for the difference between Tacitus and Pliny, and that the former was consequently in the right, is, I think, clearly established by this fact. In the same passage, Pliny gives another consular date, which is likewise two years after the date which would have been correct. Speaking of the canicular cycle, he says that the 1225th year of it (for that is evidently what we should read; the M standing for 1000 having been dropped by a careless transcriber) coincided with the year in which P. Licinius and Cn. Cornelius were consuls. Now, the year of their consulship began in October or November of the proleptic Julian year 98 B. C.; but the canicular cycle was renewed A. D. 138, according to the express testimony of Censorinus. The year which began in July, A. D. 138, was the first of the new, or the 1462nd of the old cycle; whence it is easy to see, that the year of that cycle, which would begin in September, 98 B. C., must

* Niebuhr, in the thirty-seventh chapter of the second volume of his History of Rome, points out an error of Livy of the same magnitude as this, which he attributes to a similar cause.

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be the 1227th year. The 1225th would begin two years earlier, coinciding with the consulship of Antonius and Posthumius.

This might be considered as decisive in favour of Tacitus having assigned the correct year of the arrival of the phœnix; but a confirmation from another source is certainly desirable. I find this confirmation in the chronological system of the Persians, who had also a wandering year of 365 days, and who had also periods of 600 years, of which one commenced in 1767 B. C., the very year that I have assigned for the commencement of the Egyptian cycles. That the Persian cycle began in 1767 B. C. I establish in the following manner. The era used by the later Persians was that of Yezdegird, which dates from 16th June, 632 A. D. Yezdegird appears to have reformed the Persian calendar by adding an intercalary month at the end of every 120 years; before his time the year was a wandering one, like that of the Egyptians. Now it is said that the first year of Yezdegird was the 2401st year of the old era, *supposed* to be that of Jamshid; and, if we count back 2400 years of 365 days from 16th June, 632 A. D., they will lead us to 6th February, 1767 B. C. It is, however, inconsistent with what is expressly stated on the subject, that this old Persian era should be the era of Jamshid. His era, we are told, began at the vernal equinox. We must therefore go back about 240 years to 2007 B. C., when the equinox and the Persian new year coincided on the proleptic 7th April, in order to reach the era of Jamshid. Of what then did the epoch take place in 1767? To this question I can only give one answer; and, when we couple it with the fact that the Egyptian cycles began in the same year, it must be admitted to be highly probable that the answer is a correct one. The answer is this. *In the year* 1767 *B. C. the old lunisolar cycle of* 600 *years came to an end.* The Egyptians, who were desirous of substituting the wandering year of 365 days for their ancient year, of the inconveniences of which they were long sensible, thought the arrival of this epoch a good opportunity for making the change; and the first year of the new cycle of 600 years was their first wandering year, and consequently the first year of their cycle of 1500 years. The Persians had adopted the year of 365 days 240 years before; but, on the arrival of this epoch, they counted their years from *it*, rather than from the introduction of the wandering year by Jamshid; and, what is very remarkable, they appeared to have retained the use of cycles, or rather *systems*, of 600 years, after they had totally abandoned the use of the tropical year, and when these periods had consequently lost, or at

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least changed, their cyclical character in relation to the revolutions of the moon. I say "changed;" for I am aware, that the period of 600 years of 365 days had a cyclical character, as well as that of 600 tropical years. The difference between these two was, as we have seen, 146 days, which is nearly equal to five lunations; and thus, while 600 tropical years nearly equalled 7421 lunations, 600 Egyptian or Persian years nearly equalled 7416 lunations. The latter two numbers being each divisible by 24, we have 25 Egyptian years nearly equal to 309 lunations; a cycle, which was, of course, well known to both Egyptians and Persians, when they had been any length of time using the wandering year. It is a remarkable result of what has been now ascertained that the years of the Egyptians and of the Persians were connected in a uniform manner; and that, reckoning them from their respective epochs, there could never be above a year difference in the date. The first day of the Egyptian year was the 276th of the Persian year that bore the same number; while the first day of the Persian year was the 91st day of the Egyptian year, which was numbered one less.*

But it occurred to me, that, if what I have stated be correct, there would be an important verification attainable of the fact, that the year which began A. D. 1767 was the first of a lunisolar cycle. It must have the astronomical characters of such a year. These characters are not to be sought in the Persian year, which began 6th February, 1767, nor yet in the Egyptian year, which began 8th November, 1767; but evidently in the old year, such as existed in antediluvian ages. This year is generally admitted to have begun at the autumnal equinox. Now the point to be ascertained was this. Was the new moon, which occurred

* I have derived my information respecting the Persian year from a comparison of what is stated in the Encyclopedia Metropolitana; Art. Calendar (where the authority quoted is Playfair's Chronology) with Barret on the Zodiac, p. 7, who quotes Fréret. I have endeavoured to separate the facts stated by these writers on ancient authority from their own inferences from them. The former I have retained; the latter I have criticised, and in general rejected.

The historic facts mentioned by these authors are the three following, viz. that the era of Yezdegird commenced on the 16th June, A. D. 632; that the first year of it was the 961st of a period of 1440 years, which had been preceded by another similar period; and that after the time of Yezdegird a month was to be intercalated at the end of every 120 years. The nature of the year before Yezdegird is matter of hypothesis. Fréret supposed it to have had intercalary months in the same manner as afterwards. I cannot but regard this opinion as unfounded. If Yezdegird made no change in the form of the year, there appears no reason for the Persians dating their years from his reign. He was an unfortunate prince, with whom his dynasty ended.

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nearest to the autumnal equinox in 1767 B. C., at such a distance from the equinox as would naturally result from the incorrectness of former cycles? On examining into this matter, I found that it was precisely so. In 1767 B. C. the autumnal equinox occurred on the 8th October, and the new moon four days after, on the 12th. Now the new moon gained on the equinox about a day in each cycle of 600 years; consequently, in 3567 B. C., three cycles back, the new moon would occur the day after the equinox; and, taking into account the uncertainty of observation, at that early age, we might very well place the commencement of the series of cycles at that epoch. Those, however, who, with the early Christians, and most of the learned in modern times, adopt the chronology of the Septuagint version of the Scriptures, will naturally place the commencement of this series of cycles at the autumnal equinox 4167 B. C., when the coincidence of the equinox with the new moon was still more exact.

There is only one other subject, connected with the Egyptian year, on which I feel it necessary to make any remarks; and that is the canicular cycle. I conceive that what I have said has completely overthrown the theory of Fréret, followed by many in our own day, that two such cycles had elapsed in 138 A. D.; or that the first year belonging to these cycles began in July 2783 B. C. It is *possible*, that in 1323 B. C., the heliacal rising of Sirius being observed on the first Thoth, a cycle may have been adopted, grounded upon the occurrence of this phenomenon. But it seems much more probable, that some astronomer of the Alexandrian school, under the Ptolemies, observing the day on which Sirius then rose heliacally, and observing the rate of the progress of its rising (a day in four years) calculated at what time the rising would take place on the 1st of Thoth; and commenced the cycle proleptically at that time. In either case, we must suppose the Menophres, from whose time the years of this cycle are dated by Theon, to have been an Egyptian king; and there is no name to be found in Manetho, so likely to have been he, as Mephres of the eighteenth dynasty; who was probably the last Thothmos but one (the third or fourth); he whose sister shared the government with him in the beginning of his reign.* The interval

* In identifying this Thothmos with Mephres, (though not with Menophres,) I follow Champollion and Rosellini, who, however, makes him the *fourth* Thothmos, supposing there to have been in all five sovereigns of that name. I feel reluctant to differ from Mr. Wilkinson on this subject; but the evidence on which the identification rests is such as to carry conviction to my mind. This

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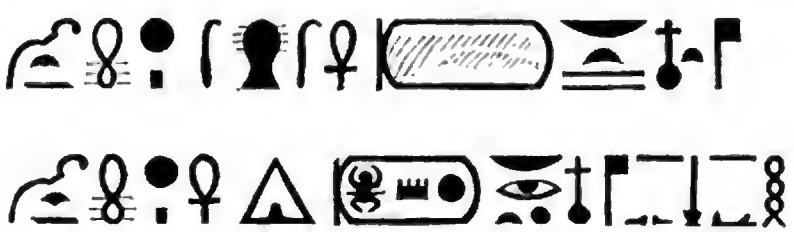
between him and Rameses the Great, indicated by the monumental series, is not inconsistent with the supposition that the former reigned in 1323, and the latter in 1167.

Thothmos, we know, assumed the title Mæ-Re or Mæ-Phre, "lover of the sun;" for it appears in several of his shields; and he was the third in genealogical ascent from the "Memnon" of the vocal colossus, as Manetho makes Mephres to be. The father of Amenophis Memnon was, according to Manetho, Thothmosis; and the father of the Amenoph, of whom the colossus is a statue, was a Thothmos. Lastly, the son of Amenophis Memnon is called Horus by Manetho; and the son of this Amenoph has for his hieroglyphical name Amun-men Har-em-heb, "Horus in a panegyry;" —a coincidence of the most striking description. It is satisfactory to find the latter part of this name written *without abbreviation* in the twelfth plate of Mr. Wilkinson's Ancient Egyptians, as the name of the royal scribe who presides at the feast. The name is analogous to Muth-em-vaa, Har-em-vaa, Phtha-em-vaa, &c., i. e. "Muth in a barge," &c., which are common Egyptian names. But, to return to our Thothmos.—The only objection, that I am aware of, to his being Mephres, is the length of his reign. Manetho makes Mephres to have only reigned twelve years and nine months; but the thirty-fourth year of Thothmos is mentioned on the monuments. I answer this objection as follows:—Manetho, in giving this short reign to Thothmos, limits it to the time, during which he reigned alone after the death or deposition of his sister; but Thothmos dated the year of his reign from the period when he ascended the throne in conjunction with her, though, probably from his youth, with only nominal sovereignty. If his sister were the queen who erected the obelisks at Karnak, as I presume she was, we know that she took the credit of them entirely to herself, and the subsequent erasure of her name by Thothmos is a proof that there was little friendly feeling between the joint sovereigns, and affords ground for suspecting that the partnership in the crown, such as it was, was put an end to with violence.

But that Thothmos was really king in conjunction with his sister, and of course that he would count her reign as a part of his own, is proved by a statue in the British Museum, the inscription on which commemorates the reigning sovereigns as



that is, "the good goddess, the lady of the worlds, (defaced) may she live and be established like the Sun for ever! and her brother, the good god, lord of 'Achth,' (the Sun establishing the world, i. e. Thothmos III.,) may he live like the Sun for ever!" In the case of a single sovereign, we find the

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I will now conclude this paper, which has much exceeded the limits that I at first contemplated. I entertain a confident hope that, if attentively considered, it will be found to establish some important points of chronology, and to establish them in perfect consistency with divine revelation.

title "Lord of the Worlds," prefixed to the first shield, while the title "Lord of Aehth" precedes the shield which contains the phonetic name. I am not satisfied as to the meaning of this title; but the name Νεφαχθώς, given by Diodorus to the father of Bocchoris, seems to be the expression of it in Greek characters.

In Manetho's list of the eighteenth dynasty, as handed down to us by Josephus and others, the name of Mephres immediately succeeds that of Amessis, i. e. Amenset, the sister of the first Amenoph. Rosellini supposes the sister of Amenoph to be the queen of the Karnak obelisks, and makes Mephres her son. Not having access to his work, I cannot say on what evidence he assumes this relationship to have existed between that queen and Mephres; but it is certain that Thothmos III. was brother, and not son, to the queen of the Museum statue; so that, if he were son to the queen of the Karnak obelisks, there must have been two queens regnant, his mother and his sister. However this may be, I feel quite satisfied that Queen Amenset, the sister of Amenoph I., was a distinct person from the queen who erected the Karnak obelisks.—I cannot venture to write down her name. I am inclined to think that three names are wanting in our copies of Manetho's list of sovereigns, answering to Thothmos I., Thothmos II., and Queen Amen—(?). We know that there is a deficiency of sixty years in *some* part of Manetho's list; for the total duration of the dynasty is distinctly stated by Josephus, more than once, to have been 393 years; while the sum of the reigns in the present copies of his list is only 333 years. Three reigns might well comprehend the sixty years that are deficient; and a copyist, having before him two queens' names *beginning alike*, might by an easy mistake place after the former of them the successor of the latter, omitting the second queen and the intervening kings. As for Mr. Wilkinson's hypothesis respecting Thothmos III., I consider it to be completely overturned by the fact, of which he does not appear to be aware, that his sister shared the government with him, or rather held it almost exclusively, in the early part of his reign. It has been also refuted on independent grounds, in a very satisfactory manner, by the author of the papers on the Pyramids in Fraser's Magazine.

The instances in which the Egyptian throne was filled by joint sovereigns, are already known to be pretty numerous; and further researches will doubtless augment their number. Amenoph III. had a brother, who for a time shared the government with him. Queen Taosre, who reigned in the interval between Rameses II. and Rameses III., had a brother, as well as a husband, for her partner in the throne. And I would suggest to the students of Egyptian literature, as well worthy of inquiry, whether the three sons of Rameses III. were not *joint sovereigns*; nay, whether all the other kings of that name, whose tombs are in the valley of the kings at Thebes, but of whose existence there seem to be no other monuments, were not the immediate descendants of these three kings, reigning cotemporaneously, and not in succession.

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It may be well to annex the following series of chronological epochs, dated according to the principles which have been established in this paper :—

B. C.

3567. Oct. 20. A lunisolar cycle of 600 years commenced, the new moon and autumnal equinox coinciding.

2967. Oct. 16. Another similar cycle commenced.

2367. Oct. 12. Ditto. The knowledge of these cycles was preserved through the Deluge; and, subsequently to it, when Egypt was peopled, the years were reckoned according to this cycle; though the commencement was placed about a month after the equinox, when the Nile had fallen to a certain level, or rather when the sun had attained $12\frac{1}{4}^{\circ}$ south declination.

2007. April 7. Jamshid, king of Persia, introduced a wandering year of 365 days, which he made to commence at the vernal equinox, in place of the autumnal. The use of the cycle, of which this was the 361st year, was still retained.

1767. Feb. 6. The lunisolar cycle was renewed according to the Persian reckoning; and accordingly this was reckoned as the beginning of their *first* year. Their years were now arranged in periods of 120 and 1440, as well as of 600 years; and these were all years of 365 days.

1767. Nov. 8. The lunisolar cycle was renewed according to the Egyptian reckoning; and at the same time it was resolved that there should be no more intercalations; but that each year should consist of 365 days.

1323. July 20. Egyptian year 445, Thoth 1st; the first year of Menophres commenced.

1167. Nov. 4. Egyptian year 601, Choiac 27th; the lunisolar cycle was renewed. The phœnix of Sesostris appeared.

747. Feb. 26. Egyptian year 1021, Thoth 1st; the first year of Nabonassar commenced.

567. Oct. 31. Egyptian year 1201, Paoni 23rd; the lunisolar cycle was renewed. The phœnix of Amasis appeared.

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B. C.

527. Jan. 2. Egyptian year 1241, Thoth 1st; the first year of Cambyses commenced.

332. Nov. 14. Egyptian year 1437, Thoth 1st; the first year of Alexander commenced.

267. Oct. 29. Egyptian year 1502, Thoth 1st; the cycle of the Seasons was renewed. The phœnix of Ptolemy appeared.

30. Aug. 31. Egyptian year 1739, Thoth 1st; the first year of Augustus commenced.

26. Aug. 30. Egyptian year 1743, Thoth 1st; the first day of the first fixed year; first used in Alexandria, and by degrees in all Egypt. Their 1st Thoth coincided with the 30th August in the years 26, 22, 18, &c. B. C.; but with the 29th in every other year.

A. D.

34. Oct. 27. Egyptian year 1802, Athur 14th; the lunisolar cycle was renewed. The phœnix of Tiberius appeared.

P. S.—I think it right to mention that, since the foregoing sheets were written, my views respecting the primary division of the Egyptian year have undergone a slight modification. I offered it as a not improbable conjecture, that a division of the year into three nearly equal seasons preceded the division into twelve months of thirty days each, with *epagomenæ* at the end. I am now quite satisfied, not only that this was the case, but that these seasons were subdivided into months containing alternately thirty and thirty-one days; the thirty-first day of the last month being dropped in the ordinary years; and that it was while this division subsisted, that the hieroglyphical notation of the months was adopted, and that the mythological connexion between them and the different deities was established. I was led to see this by considering the positions which the equinoxes and solstices would have in a year commencing on the first day that the Sun's south declination exceeded $12\frac{1}{4}°$. About the time of the reformation of the calendar in 1767 B. C. the vernal equinox would occur sometimes on the 150th and sometimes on the 151st days of such a year; while the summer solstice would fall sometimes on the 244th and sometimes on the 245th. But, if we go back a few centuries to the time when we may naturally suppose that

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the names and the mythological patrons of the several months were assigned to them, the vernal equinox and the summer solstice would both fall a day later in the year. Now, it has been satisfactorily shown by M. Biot, that the normal position of the vernal equinox, according to his view of the matter, that is, according to mine, its position in the old fixed year, was in the fifth month, Tybi; while that of the summer solstice was in the ninth month, Pachon; and should have been at its very commencement. If we suppose, as I now do, that the months primarily consisted of thirty and thirty-one days alternately, both these conditions would be exactly complied with. The 151st and 152nd days of the year, between which the vernal equinox would fluctuate, would be the 29th and 30th days of Tybi; while the 245th and 246th days, on one or other of which the summer solstice would fall, would be the 1st and 2nd days of Pachon. On the other hypothesis of twelve equal months, and five or six epagomenæ at the end, the vernal equinox would fall out of the limits of Tybi; while the summer solstice would not occur before the 5th or 6th of Pachon. From these considerations it now appears to me quite evident, that the equalization of the months took place very little before the introduction of the wandering year, for which it prepared the way; if, indeed, the two changes did not take place at the same time; the five extra days of the alternate months being gathered together at the end of the year, on the occasion of the wandering year being substituted for the fixed one.

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ANTIQUITIES.

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ANTIQUITIES.

ART. I. *Remarks on the Book of Mac Firbis, an Irish Manuscript lately transcribed for the Academy. By* GEORGE PETRIE, Esq., R.H.A., M.R.I.A.

Read 27th February, 1837.

MORE than a year since I had the honor of suggesting to the Council of the Academy the importance of obtaining from its proprietor, Lord Roden, a loan of an Irish manuscript of great celebrity, in order that a transcript of it might be made for our library; and this suggestion having been acted on, the manuscript was placed in our hands for this purpose by that distinguished nobleman, through the friendly medium of the Dean of Saint Patrick's. As the Council afterwards did me the honor to entrust to me the care of having this transcript made, I feel it my duty now, on its completion, to submit it to the Academy for their inspection, and to make a few remarks on its nature and contents, in order that the Academy may be enabled to judge not only of its value and importance as a historical record, as well as of the pains which have been taken by the persons employed to render it as perfect as possible, but also, that the Academy may feel satisfied that the funds which have been applied to this purpose have not been injudiciously expended. Another object which I propose to myself in offering these observations is, to obtain the sanction of the Academy for prefixing to the volume, previously to its being bound, a short record of the circumstances under which it was made; and, as the transcript has received the addition of much important co-relative matter, not included in the original manuscript, that a notice may be added of the sources from which such additional matter has been obtained, and how it is distinguished in this transcript.

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The original manuscript, which I also lay on the table, is, as will be seen, a small quarto on paper, containing 957 pages, all of which, with the exception of a few towards the end, are in the handwriting of the compiler, the celebrated Irish hereditary antiquary, Duald Mac Firbis; and the pages not written by him are in the handwriting of the no less celebrated antiquary Michael O'Clery, chief of the annalists, popularly called the Four Masters, of whose great work the autograph is in the library of the Academy. The contents of the volume may be described in general terms as historico-genealogical, being a history of the several colonies who established themselves by conquest in Ireland, with genealogies of the principal families who descend from them, carried down in many instances to the time of the compiler. The nature and extent of this collection will be best understood from the following abstract of its contents, which, however, for the sake of brevity, I am obliged to compress into a very narrow compass.

The writer commences with this title of the work, in the manner of Irish writers of his own time, as follows:—

"The branches of relationship and genealogical ramifications of every colony that took possession of Ireland [*carried*] from this time up to Adam, (excepting only those of the Fomorians, Lochlons, and Sax-Galls, of whom we, however, treat, as they have settled in our country,) together with a sanctilogium and catalogue of the kings of Ireland; and finally, an index, which comprises, in alphabetical order, the surnames, and the remarkable places mentioned in this book, which was compiled by Dubhaltach Mac Firbis of Lecan, 1650."*

The writer then proceeds to give the title of the work, after the manner of the old Irish authors, giving an account of the time, place, author, and object of the work, as follows:—

"The place, time, author, and cause of writing this book, are:—the place, the college of St. Nicholas, in Galway; time, the time of the religious war between the Catholics of Ireland and the heretics of Ireland, Scotland, and England, particularly the year 1650; the person or author, Duald, the son of

* "Cpaoba coibneaſa agus geuga genealuiġ gaċa gabala dap ġab Ɛpe on amſa go haḋaṁ (aċt Foṁoraiġ Loċlonaiġ agus Saxġaill aṁain laṁam o ṫangadap dap ttip) go naoiṁſeanċus agus pempioġpuiġe Foḋla ſoſ. Agus ſa ȯeoiġ cláp na ccuimſiġṫeap (iap nupo aibgiope) na ſloinnte agus na haite oipḋeapca luaiteap iſin leabapſa do teaglomaḋ leſan Dubaltaċ mac Fipbiſiġ Leacain 1650."

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Giolla Iosa more Mac Firbis, historian, &c. of Lecan Mac Firbis in Tireragh on the Moy; and the cause of writing the book is to increase the glory of God, and for the information of the community in general."

In the introduction which follows, and consists of 18 pages, the compiler argues ably in support of the authenticity of the ancient history and genealogies of the Irish, and of their claims to early civilization, particularly in literature and the architectural art. He gives, from ancient authorities, the names of the poets, law-givers, historians, harpers, and builders, who came with the early colonies, as well as of those writers most distinguished in subsequent times, of whom he states, that it would require a whole volume to mention only the names.

"With regard to our later writers," he adds, "who flourished within the last 600 years, here follow the names of some of them:—the *O'Mulconrys* were the hereditary Bards of Connaught, and some branches of them were Bards of Thomond, some of Leinster, and some of Annaly, (now Longford;)—the *Clan-Firbis* were the hereditary Bards of Lower Connaught, (i. e. of the County of Sligo,) of Hy Fiachrach Moy, of Tir-Amalgaid, (Tirawly,) of Cera, of Hy Fiachrach Aidne, of Eachtga, and of the race of Colla Uais, that is, of the Clan Donnell; the *O'Curnins* were the hereditary Poets of the O'Ruarks of Brefney, (now the County of Leitrim;) the *O'Duigenans* were the Poets of the Mac Dermots, called Clan Malroney, and of Conmacne of Moy-Rein; the *O'Duvegans* in Hy-Maine, followed them; the *O'Clerys* and the *O'Keenans* were the Poets and Historians of Tirconnell; the *O'Luinins* were the Poets of Fermanagh; the *O'Clercens*, of Tyrone; the *O'Duinins*, of South Munster, that is of the descendants of Eogan More, namely, the Mac Carthys, the O'Sullivans, &c.; the *Mac an Ghabhans*, of Ormond; the *O'Riardans*, of Eile; the *Clan Crutins* and *O'Brudins* in Thomond; the *Mac Gilkellys*, in Western Connaught with the O'Flahertys, and so on.—Every district had its Bard and its Brehon, or Judge; and the genealogies were so accurately entered in their books, that he who refuses credit to them, may equally deny faith in his father or grandfather, since our fathers and grandfathers were our witnesses, each generation committing them to the care of their successors.

"Neither was there any order, lay, or ecclesiastic, in Ireland, which was not bound by penalties, as stated in our *Law books*, and on pain also of loss of honor and reputation, to preserve their genealogies and histories, so that on comparison

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with those of other districts and churches, they should be found to correspond; and it was ordained by law that there should be always seven ranks or orders of the learned to inspect those books, namely, 1, the *Ollamhs*; 2, the *Anrads*; 3, the *Cli*; 4, the *Cana*; 5, the *Dos*; 6, the *Mac-Fuirmid*; 7, the *Fochlag*. The order of *Fileas* were, by law, to be of free families, and of spotless integrity with respect to theft, murder, extortion, adultery, &c.

"The Irish historians, not content with recording the history and customs of the nobility, have also written concerning the physicians and tradesmen of old times, and hence we know who the builders were of our first *Raths* and *Duns*, from the poems of the ancients; and if those ancient buildings have disappeared, be it remembered how many fine castles have been levelled to the ground and disappeared in our own memories, or fallen of themselves from neglect. I myself have, within the last sixteen years, seen high and strong castles of lime and stone, and now nothing remains but the moats of earth to indicate where they stood; and need we wonder if strong places which were built 2000 years, after the manner of eastern nations, such as Spain, &c. whence colonies came into Ireland, have disappeared also?—Nor have they entirely disappeared either, for there are still remaining royal and extensive *Raths* in all parts of Ireland, in which are many chipped and smooth stones, and subterranean crypts or chambers, as at *Rath Maoilcatha* at Castle Conor, and at *Ballydowd* in Tireragh, on the banks of the Moy. There are nine subterranean chambers formed of smooth stones within that ancient *Rath*. I was within this Rath, and deem it one of the oldest in Ireland."

He says that the history which he gives was written in books from time to time, from the deluge, by elders and persons vouchsafed by God, down to the time of Saints Patrick, Columb, Comgall, Finen, &c., who wrote after them, and handed the accounts down to succeeding ecclesiastical and other writers, so that it is to be found on holy altars, in libraries, in the hands of seniors, doctors, and historians at this day, and will for ever.

He then adds, that the work is divided into nine books. The first treats of the arrival of the colony of Partholan, about 300 years after the flood; the second, of the arrival of the Nemedians; the third, of the conquest of Ireland by the Firbolg, or Belgæ; the fourth, of the Tuatha De-Danaans; the fifth, of the Gaels, or Milesians; the sixth, of the race of Ir and Dal Fiachach; the seventh,

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of the race of Ebhir, and of the saints descended from Lughaidh, the son of Ith, who possessed one division of Munster; the eighth, of the saints of Ireland; and the ninth and last, of the Fomoraigh, or sea-robbers from Africa, the Danes and the Saxons, or Anglo-Normans.

The first and second of these books, as Dr. O'Conor remarks, (*Bibl. MS. Stow.* vol. i. p. 141,) are fabulous and brief: they end at page 37. The pedigree of the Campbells, or Mac Allens, of Scotland follows, and is particularly valuable, not only as an unpublished historical record of that great clan, but also as preserving the Irish historic tradition, that they were not of the Scotic, but of the Belgic race.

The third book, which contains the history of the Firbolgs, commences at page 47, and ends at page 74. This book contains a list of the territories named from this colony, and of the tribes anciently located in them. This book is characterized by Dr. O'Conor as the best account of the Irish Belgæ extant, (*ubi supra,*) and called forth the following observation from his grandfather, the venerable Charles O'Conor of Belanagare. "It is particularly valuable by rescuing from oblivion the names of districts and tribes in Ireland antecedently to the second century; since which the Scots have gradually imposed new names of their own, as they were enabled from time to time to expel the old Belgic inhabitants. It is a most curious chart of ancient topography, and vastly preferable to that given by the Alexandrian geographer, Ptolemy, who must have known but little of Ireland, wherein the Romans never made a descent." (*Pref. to Ogygia Vindicated,* p. ix.)

This book also contains at page 49 a list of the battles fought by Tuathal against the Attacots; and at page 54 an ancient historical poem of 164 verses, reciting the leading features of the history of the Belgæ.

The fourth book, which begins at page 75, and contains the history of the Tuatha De-Dananns, gives the names of their territorial divisions, with lists and genealogies of their kings and other distinguished persons. This occupies 9 pages, and ends at page 84.

The fifth and succeeding books, with the exception of the last, are devoted to the history and genealogies of the Milesians, and commences at page 84. The pedigrees commence at page 114, with the northern tribes of the Kinel Owen—the O'Neills, Mac Loughlins, O'Kanes, O'Gormleys, &c. &c.; these terminate at

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page 150. The pedigrees of the Kinel Connell, or families of Donegal, follow, as O'Donnells, O'Boyles, O'Doghertys, &c.; and at page 159 there is a list of the chiefs of Tirconnell down to the year 1600.

Page 161,—Next follow the genealogies of the Clan Colman, of whom the O'Melaghlins, kings of Meath, were the most distinguished family.

Page 163,—Next follow the genealogies of the posterity of Hugh Slaney, from whom the O'Kellys and other families of Bregia descend. Next, of the posterity of Carbry, the son of Niall. Next, of the posterity of Fiacha, the son of Niall,—the Macgeoghegans, Molloys, &c. Next, of the posterity of Maine, —the Foxes, Magawleys, O'Breens, &c.

Page 212,—The families of Connaught descended from Muireadhach Muilleahan,—the O'Conors, Mac Dermotts, Mac Donoghs, O'Malroneys, &c. Then follow the names, order of succession, and chronology of the Christian kings of Connaught, taken from an ancient poem.

Page 261,—The genealogies of the families of Tireragh on the Moy, the Mac Firbises, O'Dowds, &c.; with an account of their territories.

Page 270,—Genealogies of the families of Ceara, in Mayo.

Page 272,—Genealogies of the families of Tirawley, in the same county.

Page 277,—A poem of 892 verses, by Giolla Iosa more Mac Firbis, enumerating the families of Tireragh and Tirawley and their inheritances.

Page 299,—The history and genealogies of the families of Oriel,—Maguires, Mac Mahons, &c.

Page 320,—The history and genealogies of the families of Hy-Maine in Connaught,—the O'Kellys, &c.

Page 330,—An ancient poem of 160 verses, by Giolla na naomh O'Dunn, on the genealogies of the families of Oriel, a district embracing the present counties of Louth, Armagh, and Monaghan.

Page 334,—The history and genealogies of the Heremonians, in the southern half of Ireland.

Page 400,—The history and genealogies of the Dalriads, or Irish colony, in Scotland, drawn from Irish and Scotch authorities.

Page 408,—The genealogies of the kings of Scotland.

Page 414,—An ancient poem of 108 verses, detailing the succession of the kings of Scotland down to Malcolm, the son of Donogh, in whose time the poem

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was written. This is the celebrated poem so essential to Scottish history, which has been published from this very copy by Pinkerton and by O'Conor; and no other ancient copy is now known to exist, nor could any other be found in the time of O'Flaherty, more than a century since.

Page 418,—An account of the settlement of the Picts in Scotland, and of the wars of the Picts and Scots with the Romans. This tract, which is written in Latin, and occupies five pages, is a very valuable document, and, I believe, as yet unpublished.

To this is appended, in our transcript, fourteen pages of very interesting matter not found in the original work, but copied from an insertion by Mac Firbis himself in an abstract of it written in 1666. It gives an account of the first establishment of the claims of the Milesians to the Scottish sovereignty, and of the succession of the Stewarts, their genealogy, intermarriages, &c.; with a collection of some Irish and Scottish surnames.

Page 426,—A list of the Christian kings of Leinster, from an ancient poem.

Page 430,—The history and genealogies of the Lagenian families, descended from Leary, the son of Hugony the Great.

Page 461,—Genealogies of the descendants of the monarch Cathaoir more.

Page 472,—Ancient and modern compilations of the genealogies of the Leinster families, as the Mac Murroghs or Cavanaghs, O'Byrnes, O'Tooles, Fitz Patricks, &c.

Page 485,—The history and genealogies of the families descended from Ir, son of Milesius,—the ancient Ultonians.

Page 491,—A short metrical and prose extract from the book of Sabhall Phadraig, (now Saul, county of Down,) treating of the Ulidians.

Page 493,—An account of the families of the Ulidians, called Dal Fiatach, taken from the book of Saul.

Page 505,—An account of the poets of Ireland and Scotland.

Page 514,—An account of the Dalaradians.

Page 535,—An account of the descendants of Fergus Mac Roigh.

Page 556,—The history and genealogies of the families of Leix.

Page 561,—Genealogies of the Ultonians, from the book of Saul, Psalter of Cashel, Book of Lecan, &c.

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Page 564,—Genealogies of the families of Leix,—the O'Mores, O'Kellys, O'Dowlings, O'Lawlers, O'Dorans, &c.

Page 589,—An ancient poem of 320 verses, on the Irian kings of Ulster.

Page 599,—History and genealogies of the Momonians.

Page 658,—A quotation of 72 verses, from O'Dugan's topographical poem, respecting the Delvins.

Page 665,—Genealogies, &c. of the families of Gallen and Leyney,—the O'Haras, O'Garas, &c.

Page 688,—A list of the kings of Munster, down to Donnell O'Brien, in the twelfth century.

Page 692,—History of Irish saints.

Page 696,—Pedigrees of Irish saints.

Page 754,—The chronology of the kings of Ireland, compiled from the Annals of the Four Masters, which Mac Firbis calls the Book of Fergal O'Gara.

Page 768,—The history of the Fomorians and Danes.

Page 780,—The history and pedigrees of the Anglo-Normans.

Page 781,—A list of the names of the Normans who came over with William the Conqueror to England.

Page 786,—The history and genealogies of the English families in Ireland, viz. first the Geraldines, concerning whom two anonymous poems are given, the first consisting of 148, and the second, which was written in 1601, of 248 verses: these poems commence at page 789, and end at 798. These poems are followed by genealogies of the families of Burke, Butler, Birmingham, Gibbon, Scott, Barry, Roche, Purcell, Nugent, Costelloe, Philips, Jordan, Cumming, Walsh, Barrett, Mac Quillan, Joice, Dillon, Tyrell, Barnwall, Tuite, Darcy, Petit, Cusack, Brown, Prendergast, Tobin, Dalton, &c. &c.

Page 839,—The history of the family of Walsh, translated from the book of Laurence Walsh, written in 1588.

After page 840, ten pages have been inserted from the abstract of 1666, already referred to, eight of which are devoted to a more detailed account of the family of Nugent than that given in the original work, and the other two, of the family of Darcy.

Page 845,—A list of the chief governors of Ireland, from Earl Strongbow to Sir John Perrot, in 1584.

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Page 854,—A general index to the work, giving the proper names of men and places, excepting the saints and their churches.

Page 926,—An index to that part of the work treating of the Irish saints.

Page 935,—The topographical poem of O'Dugan, on the Northern Division of Ireland.

Page 948,—The topographical poem of O'Huidhrin on the Southern Division of Ireland. This poem, which is in the handwriting of Michael O'Clery, ends the volume at page 957.

Such are the principal contents of this valuable manuscript, which, it will be seen, contains much important historical matter not to be found elsewhere, and which it was of great importance should be deposited in some public library, easy of access to those who could turn it to useful account, as well as that the chance of its loss, while dependent on a single copy, should be diminished, by the existence of a faithful transcript. Of its value the Academy will form some idea from the following observations, made by one in the highest degree qualified to form a just estimate—I allude to the venerable Charles O'Conor of Belanagare, who writes as follows in his preface to Ogygia Vindicated, p. xx. "Ptolomey could know but little of Ireland in the second century; his defects, however, have been supplied in the Lecan records, as copied by the late celebrated Mac Firbis. In that copy (now in the hands of the Earl of Roden,) we have an account of the several tribes of Ireland in the beginning of the second century. It throws additional light on the history of that and some subsequent ages, and is undoubtedly the most ancient document of Celtic topography hitherto discovered."

That the transcript now finished is not inferior in penmanship to the original manuscript, will be obvious to every one who inspects it. But I have the pleasure of adding, that it is superior in many more important respects. The original has suffered much injury from its margins having been cut down by a modern binder, and a considerable portion of its contents has been wholly obliterated by stains. The losses thus sustained have nearly all been supplied from two abstracts of the work now, through the favor of their proprietors, in my hands. The first of these was written in 1726, by James Maguire of Slieve-da-Con, in the county of Fermanagh; and the second is a transcript from an abstract of the original work, with considerable additions, made by Mac Firbis himself in 1666. And

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here it may not be improper to state, that the existence of this amended abstract was unknown to Charles O'Conor of Belanagare, the best informed Irish scholar of the last century, though he was aware of Mac Firbis's intention of writing it, as he thus states, in speaking of the original work, in his preface to Ogygia Vindicated, p. ix. "Of that work Mac Firbis intended a second draught, (as he intimates,) with amendments and corrections, but whether he executed his design we cannot learn." In this abstract the compiler re-wrote many introductory passages, corrected many errors, continued the pedigrees in many instances down to that period, and added many collateral names not included in the original work. In our transcript all these improvements, corrections, and additions have been carefully inserted from both works; and that they should not be confounded with the text of the original, they are all distinguished by marginal references to the works from which they have been taken. In like manner it has been deemed proper to distinguish several marginal observations which occur in the original, and which were written by Charles O'Conor.

The transcript has been made by Mr. Eugene Curry, a person in every way qualified to do justice to the undertaking, whether as an Irish scholar, or a faithful scribe; and the labour and zeal which he has devoted to the work, are deserving of the highest praise. With a transcript from his hands we must have felt satisfied; but that no doubt whatever should exist of its perfection, the critical skill of another Irish scholar of the highest distinction has been called into exercise, and applied with an equal degree of patient ardour,—I need scarcely say that I allude to Mr. J. O'Donovan, by whom the whole work, word for word, and letter for letter, has been most carefully compared with the original.

In connexion with a notice of a work so important, it would not be improper to add some biographical account of its author; unfortunately, however, but few materials now exist to enable me to give such a sketch as would be satisfactory, or as the subject deserves.

Of his private history, all that is known may be told in a few words. He was a native of Lecan, in the county of Sligo, called Lecan Mac Firbis, from his ancestors, who, from the earliest times, were hereditary historians and antiquaries of the lower Connaught. It is to them that we owe the valuable manuscript volume called the Book of Lecan, which was compiled in the 14th century, and which is now one of the distinguished boasts of our library.

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In the calamities of the civil wars of 1641 this family lost their hereditary possessions; but the ruins of their castle, bearing their name, still survive, and give melancholy interest to a dreary landscape.

The year of his birth is not recorded, but it is known that, in order to perfect his education as an antiquary, he was placed at an early age under the tuition of the Mac Egans, hereditary Brehons or judges in Ormond, from whom he acquired a profound knowledge of the Brehon laws. In subsequent years he employed himself in several works which he considered essential to the preservation of Irish literature; and after the loss of his hereditary property he was employed as a translator and assistant by the celebrated Sir James Ware. Some of the translations made for the latter are to be found in the library of the British Museum. To these meagre facts I can only add that of his death, which, as we learn from Charles O'Conor, was tragical,—for this last of the Mac Firbises was unfortunately murdered at Dunflin in the county of Sligo in the year 1670. The circumstances connected with this event were known to that gentleman, but a proper respect for the feelings of the descendants of the murderer, who was a gentleman of the country, prevented him from detailing them. They are, however, still remembered in the district in which it occurred, but I will not depart from the example set me, by exposing them to public light.

Of the other works of Mac Firbis, the only satisfactory knowledge which we possess is derived from himself. He states, in the preface to the work now before us, that he had written a dictionary of the Brehon laws, in which he had explained them extensively; and also a catalogue of the manuscripts and writers of ancient Ireland. Neither of these works has as yet been discovered. But there is some reason to believe that the former at least may still exist, as an Irish scholar, O'Flanagan, quoted from it about twenty years since. The discovery of this work, which Charles O'Conor has characterized as "the great desideratum of the present age," would be of the highest importance, as its loss would be an irreparable injury to Irish literature. In conclusion, I have only to add a congratulation to the Academy on their acquisition of so important an addition to their manuscript library, and on their having, by their liberality, rendered available to the public this valuable remain of the last hereditary antiquary of Ireland.

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II. *An Account of an ancient Irish Reliquary, called the Domnach-Airgid.* By George Petrie, Esq., R.H.A., M.R.I.A.

Read 22nd October, 1832; and 9th January, 1837.

THE ancient *cumdachs*, or ornamental cases, in which the Irish were accustomed to preserve their early religious manuscripts and other relics, have been within a few years elaborately illustrated and familiarized to the learned by the Rev. Dr. O'Conor, and still more recently by Sir William Betham. Till that period the present existence of those interesting monuments of our ancient literature and art was scarcely known to the literary world, as they were generally concealed in the hands of poor and illiterate persons, by whom they were preserved, and transmitted from generation to generation, either from a veneration for their supposed sanctity, or as a means of support, derived from their frequent application among the vulgar to superstitious purposes. In this manner, and from both the considerations alluded to, the very singular piece of antiquity, which I have now the honor of exhibiting to the Academy, has been long preserved and employed, as, while its safe keeping was considered by its possessors to be a religious duty, it was nevertheless hired out into the surrounding district on a sufficient deposit, and for a small consideration; sometimes that persons suspected or accused of crime might exonerate themselves from the imputation by an oath taken on its contents—a practice apparently derived from the ancient use of the sacred volume which it contains; at other times for the application of its supposed miraculous power in removing diseases both from men and cattle—a superstition probably originating in the use of the relics which it was supposed to enshrine. From such uses, and the great probability of ultimate destruction, it has fortunately been rescued by the enterprising spirit of its present possessor, Mr. Smith of College-green, the bookseller, by whom it was recently purchased in the neighbourhood of Clones in the county of Monaghan, its original locality, from one of the Maguire family, descended of the ancient lords of Fermanagh.

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In its present state this ancient remain appears to have been equally designed as a shrine for the preservation of relics and of a book; but the latter was probably its sole original use. Its form is that of an oblong box, nine inches by seven, and five inches in height.

This box is composed of three distinct covers, of which the first, or inner one, is of wood—yew; the second, or middle one, of copper, plated with silver; and the third, or outer one, of silver, plated with gold.

In the comparative ages of these several covers, there is obviously a great difference. The first may probably be coeval with the manuscript which it was intended to preserve; the second, in the style of its scroll, or interlaced, ornament, indicates a period between the sixth and twelfth centuries; while the figures in relief, the ornaments, and the letters on the third, or outer cover, leave no doubt of its being the work of the fourteenth century.

This last, or external cover, is of great interest, as a specimen of the skill and taste in art of its time in Ireland, and also for the highly finished representations of ancient costume which it preserves. The ornaments on the top consist chiefly of a large figure of the Saviour in *alto relievo* in the centre, and eleven figures of saints in *basso relievo* on each side, in four oblong compartments. At the head of the Saviour there is a representation of the dove, or Holy Ghost, enamelled in gold; and over this a small square reliquary, covered with a crystal, and which probably contains a supposed piece of the true cross. Immediately over this again is a shield, on which the implements of the passion are emblazoned in blue and red paste; and above this there is another square reliquary, similarly covered with crystal, but of smaller size. The smaller figures in relief are, in the first compartment, the Irish saints—Columb, Brigid, and Patrick; in the second, the apostles James, Peter, and Paul; in the third, the Archangel Michael and the Virgin and Child; and in the fourth, a bishop presenting a *cumdach*, or cover, to an ecclesiastic—a device which has evidently an historical relation to the reliquary itself, and which shall be noticed hereafter. There is a third figure in this compartment which I am unable to explain.

It should be observed, that these figures have been arranged by a person recently employed to repair the case, in a different order from their original one, as here given on the authority of one of a set of drawings of this reliquary, previously made, with which I have been favored by my friend Sir W. Betham.

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The rim is ornamented on its two external faces with various grotesque devices, executed with very considerable skill, and the angles were enriched with pearls, probably native, or other precious jewels. A tablet on the rim, and at the upper side, presents the following inscription in the Monkish character used in the 13th and 14th centuries:

"JOHS : O KARBRI : COMORBANUS : S : TIGNACH : PMISIT."

Or with the contractions lengthened; thus:

JOHANNES O KARBRI COMORBANUS [successor] SANCTI TIGHERNACH PERMISIT.

Another inscription, in the same character, preserves the name of the artist by whom those embellishments on the outer case were executed, and is valuable as proving that this interesting specimen of ancient art was not of foreign manufacture. It will be found on a small moulding over one of the tablets:

"JOHANES : O BARRDAN : FABRICAVIT."

The front side of the case presents three convex *paterœ*, ornamented, in a very elegant style of art, with figures of grotesque animals and traceries: they are enamelled with a blue paste, and have in the centre of each cup an uncut crystal covering relics like those on the top. An interesting feature on this side is the figure of a chief or nobleman on horseback, with sword in hand. It exhibits with minute accuracy the costume of the nobility in Ireland during the 14th century.

The ornaments contained within the rim, on the back or opposite side, are lost, and their place has been supplied by the recent repairer, with figures which originally belonged to the right and left sides. These figures are, however, restored to their proper places in the accompanying plates, on the authority of Sir W. Betham's drawings; from which it appears that these sides were originally ornamented with figures in relief, like those on the top.

On the right hand side, the upper compartment presents a figure of St. Catherine with those of a monk in the attitude of prayer on the left, and a boy incensing on the right: these latter figures are not in relief, but are engraved on the field of the tablet. The second, or lower compartment of this side is lost.

On the left hand side, the upper compartment presents the figure of an ecclesiastic seated on a chair or throne, his left hand holding a small cross, and his

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right hand raised in the act of giving the benediction: figures incensing are engraved on the field. This principal figure probably represents S. Mac Carthen, or St. Tighernach. The under compartment exhibits a figure of St. John the Baptist holding in his left hand a round medallion or picture of the Lamb; and in his right hand a scroll, on which is inscribed the words, "*Ecce Agnus Dei.*" A figure of the daughter of Herodias with the head of St. John on a salver, appears engraved on the field.—(See Plate III.)

In consequence of the removal of these tablets to the back, as already stated, the more ancient plated cover has become exposed on the two ends, as shown in Plate IV.

The bottom, or back, of the case is ornamented with a large cross, on which there is an inscription in the gothic or black letter. This inscription is of a later age than those already noticed, but I am unable, from its injured state, to decipher it wholly. It concludes with the word "cloachar," the name of the see, to which, as I shall presently show, the reliquary originally appertained.

I now come to the most important portion of this remarkable monument of antiquity,—the treasure for whose honor and preservation so much cost and labour were expended. It is a Latin manuscript of the Gospels; but of what text or version I am unable, in its present state, to offer an opinion, as the membranes are so tenaciously incorporated by time that I dare not venture, through fear of injuring, to separate them. These Gospels are separate from each other, and three of them appear to be perfect; but the fourth, which is the Gospel of St. Matthew, is considerably injured in the beginning, and from this two leaves have been detached, which have enabled us to ascertain the subject of, as well as the form of letter used in, the manuscript,—namely, the Uncial or corrupt Roman character, popularly called Irish, and similar in appearance to the very ancient manuscripts of the Gospels preserved in the library of Trinity College. That it is of equal antiquity with those manuscripts—which are of the sixth century—I have little doubt; and from evidences which I shall presently adduce, I think it not unlikely to be of an even earlier age,—perhaps the oldest copy of the Sacred Word now existing.

I shall endeavour to arrange these evidences in consecutive order.

1. It is of importance to prove that this *cumdach*, or reliquary, has been from time immemorial popularly known by the name of *Domnach*, or, as it is pro-

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nounced, Donagh, a word derived from the Latin *Dominicus*. This fact is proved by a recent popular tale of very great power, by Mr. Carleton, called the "Donagh," in which the superstitious uses to which this reliquary has been long applied, are ably exhibited, and made subservient to the interests of the story. It is also particularly described under this name by the Rev. John Groves, in his account of the Parish of Errigal-Keeroge, in the third volume of Shaw Mason's Parochial Survey, page 163, though, as the writer states, it was not actually preserved in that parish.

2. The inscriptions on the external case leave no doubt that the Domnach belonged to the monastery of Clones, or see of Clogher. The John O'Karbri, the *Comharb*, or successor of St. Tighernach, recorded in one of those inscriptions as the person at whose cost, or by whose permission the outer ornamental case was made, was, according to the Annals of the Four Masters, Abbot of Clones, and died in the year 1353. He is properly called in that inscription *Comorbanus*, or successor of Tighernach, who was the first Abbot and Bishop of the Church of Clones, to which place, after the death of St. Mac-Carthen in the year 506, he removed the see of Clogher, having erected a new church, which he dedicated to the apostles Peter and Paul. St. Tighernach, according to all our ancient authorities, died in the year 548.

3. It appears from a fragment of an ancient life of St. Mac-Carthen, preserved by Colgan, that a remarkable reliquary was given by St. Patrick to that saint when he placed him over the see of Clogher.

"Et addidit, [Patricius] Accipe, inquit, baculum itineris mei, quo ego membra mea sustento, et scrinium in quo de sanctorum Apostolorum reliquiis, et de sanctæ Mariæ capillis, et sancta Cruce Domini, et sepulchro ejus, et aliis reliquiis sanctis continentur. Quibus dictis dimisit cum osculo pacis paterna fultum benedictione."—*Colgan, Vit. S. Macaerthenni* (24 Mart.) Acta SS. p. 738.

From this passage we learn one great cause of the sanctity in which this reliquary was held, and of the uses of the several recesses for reliques which it presents. It also explains the historical *relievo* on the top—the figure of St. Patrick presenting the Domnach to S. Mac-Carthen.

4. In Jocelyn's Life of St. Patrick, (cap. 143,) we have also a notice to the same effect, but in which the Domnach is called a *Chrismatorium*, and the relics are not specified,—in all probability because they were not then appended to it.

In these authorities there is evidently much appearance of the Monkish

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frauds of the middle ages, but still they are evidences of the tradition of the country that such a gift had been made by Patrick to Mac-Carthen. And as we advance higher in chronological authorities we find the notice of this gift stripped of much of its acquired garb of fiction, and related with more of the simplicity of truth.

5. In the life of St. Patrick called the Tripartite, usually ascribed to St. Evin, an author of the seventh century, and which even in its present interpolated state is confessedly prior to the tenth, there is the following remarkable passage (as translated by Colgan from the original Irish) relative to the gift of the Domnach from the Apostle of Ireland to St. Mac-Carthen, in which it is expressly described under the very same appellation which it still bears.

"Aliquantis ergo evolutis diebus *Mac-Caertennum*, sive *Caerthennum* Episcopum præfecit sedi Episcopali Clocherensi, ab Ardmacha regni Metropoli haud multum distanti: et apud eum reliquit argenteum quoddam reliquiarium *Domnach-airgidh* vulgò nuncupatum; quod viro Dei, in Hiberniam venienti, cœlitus missum erat."—*VII. Vita S. Patricii*, Lib. III. cap. 3, *Tr. Th.* p. 149.

This passage is elsewhere given by Colgan, with a slight change of words in the translation, as follows:

"Aliquantis igitur evolutis diebus S. Maccaerthennum Episcopum, præfecit sedi Clocharensi ab Ardmacha regni Metropoli haud multum distanti: et apud eum reliquit argenteum quoddam reliquiarium *Domnach-airgid* vulgo appellatum, quod viro Dei in Hiberniam venienti cælitus missum erat."—*Vita S. Maccaerthenni* (24 Mart.) *AA.SS.* p. 738.

In this passage, which is unquestionably prior to all the others, we find the Domnach distinguished by the appellation of *Airgid*—an addition which was applicable only to its more ancient or *silver* plated case, and which could not with propriety be applied to its more recent covering, which in its original state had the appearance of being of gold.

On these evidences—and more might probably be procured if time had allowed—we may, I think, with tolerable certainty, rest the following conclusions:

1. That the Domnach is the identical reliquary given by St. Patrick to St. Mac-Carthen.

2. As the form of the cumdach indicates that it was intended to receive a book, and as the relics are all attached to the outer and least ancient cover, it is

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manifest that the use of the box as a reliquary was not its original intention. The natural inference therefore is, that it contained a manuscript which had belonged to St. Patrick; and as a manuscript copy of the Gospels, apparently of that early age, is found within it, there is every reason to believe it to be that identical one for which the box was originally made, and which the Irish apostle probably brought with him on his mission into this country. It is indeed, not merely possible, but even probable, that the existence of this manuscript was unknown to the Monkish biographers of St. Patrick and St. Mac-carthen, who speak of the box as a *scrinium* or reliquary only. The outer cover was evidently not made to open; and some, at least, of the relics attached to it were not introduced into Ireland before the twelfth century. It will be remembered also that no superstition was and is more common in connexion with the ancient cumdachs than the dread of their being opened.

These conclusions will, I think, be strengthened considerably by the facts, that the word *Domnach*, as applied either to a church, as usual, or to a reliquary, as in this instance, is only to be found in our histories in connexion with St. Patrick's time; and, that in the latter sense—its application to a reliquary—it only once occurs in all our ancient authorities, namely, in the single reference to the gift to St. Mac-Carthen; no other reliquary in Ireland, as far as can be ascertained, having ever been known by that appellation. And it should also be observed, that all the ancient reliques preserved in Ireland, whether bells, books, croziers, or other remains, have invariably, and without any single exception, been preserved and venerated only as appertaining to the original founders of the churches to which they belonged.

Since the preceding pages were written, the Domnach has become the property of the Hon. Henry R. Westenra, at a cost of three hundred pounds. That truly patriotic gentleman immediately on his becoming the possessor of this interesting monument of the *Insula Sacra*, honored me with a request that I would communicate to the Academy and to the University, that, as his only object in becoming its purchaser was that it might not pass out of Ireland, he would be at all times ready to surrender it to either of these national institutions, as a proper depository for its preservation, at a loss of a portion of the sum which it cost him. A liberality so enlightened will, I have no doubt, be admired and honored.

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I also avail myself of this opportunity to add, that, having been favored, recently, by Mr. Westenra, with a loan of the Domnach for further examination, I requested my friend, the Rev. Mr. Todd, to examine the detached membranes of the manuscript, and to give me his opinion respecting the antiquity of the version and age of the writing, as far as the fragments would permit such opinion to be formed. I now add his transcript of what was legible, together with his remarks; and I am authorized by him to state, that although he at first thought the contractions used in the fragment,—and especially the (;) in the contraction *usq;*—to argue a later date than the historical evidences indicated, he has since seen reason to change his opinion. While this sheet was passing through the press, he took the opportunity of re-considering the subject, by a careful examination of the valuable manuscripts of the Gospels preserved in the Library of Trinity College; and he now thinks that the contractions of the Domnach manuscript might have been in use in the fourth or fifth centuries.

It should be observed, that the type in which the following fragments are printed is not to be considered as a fac-simile of the MS., in which the letters are larger, but it will give a very good general idea of the character, having been cast from the best specimens of Irish MSS. of the sixth and seventh centuries.

COLLATION OF TWO LEAVES OF THE DOMNACH-AIRGID MANUSCRIPT.

Fol. 1, *facie.*

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. . . . .	1
tionis ih . . . . . i	
dauid filii abra	
am abracham	2
genuit issac issac ir genuit ia	
cob iacob ir genuit iudam et fra	
. . . . . eius-iudas ir g.. uit fra	3
tres . . . . is et zaram	
. . . . .	

Ver. 1. A space is left for an illuminated L, of which some faint traces still remain.

Ver. 2. *Isaac autem.*—Vulg. The Versio Antiqua (ap. Sabatier) omits *autem.*

Ver. 3. A stop between *ejus* and *Judas* in the middle of the line. The reading appears to have been "Judas autem genuit fratres pharis et zaram," a reading altogether peculiar.

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Fol. 1, *dorso.*

	Mat. i.
. . . . . ABIA	7
. . . . . NUIT ASSA . . ASSA IR GENUIT	8
. . . . . T IOSAPHAT IR GENUIT IO	
RAM IORAM IR GENUIT OZIAM OZI	9
AS IR GENUIT IOTHAM IOTHA IR GENU	
IT ACHAZ ACHAS IR GENUIT EZECHI	
AM EZECHIAS IR GENUIT	10
SEN MANESSES IR GENUIT	
. . . . IR GENUIT . . . . . IOSIAS . . .	
. . . . .	

Ver. 7, 8. This is evidently the modern Vulgate; the old version reads *Abiud*, instead of Abia, or Abias; and *Asaph*, instead of Asa or Assa.—Vid. *Sabatier.*

Ver. 10. *Josias.*—This word is very obscure; the second ı in the original is elongated below the line, and has a curved line ∽ over it.

Fol. 2, *facie.*

	Mat. i.
ECIU . . . . . GE	15
IR GE IACOB IACOB IR GENUIT	16
OMNES ERGO GENERATIONES	17
AB ABRACHAM USQ; AD DAUID	
GENERATIONES XIIII ET A DAUID	
USQ; AD TRANSMIGRATIONE BABIL . .	
NIS GENERATIONES XIIII ET A TRANS	
MIGRATIONE BABILONIS USQ; AD	
CRISTUM GENERATIONES X	

Ver. 15. A part of this verse appears to have been omitted, as there is not room left for the whole in the manuscript.

Ver. 16. The clause "virum Mariæ, &c." appears to have been omitted. This clause is given very variously in manuscripts, the Vulgate reads "Virum Mariæ, de qua natus est Jesus, qui vocatur Christus." The ancient version (in Sabatier) reads, "Cui desponsata virgo Maria. Maria autem genuit Jesum, qui dicitur Christus." One manuscript in the Library of Trinity College (the book of Dimma) unites both readings thus, "Virum Mariæ de qua natus est Jesus Christus. Cui dispon-

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sata virgo Maria. Maria autem genuit Jesum qui dicitur Christus." The Domnach manuscript appears to be singular in omitting the whole clause.

Ver. 17. *Omnes ergo.*—The modern vulgate reads *itaque*, the ancient version *ergo*, as in this manuscript. In the rest of the verse this manuscript agrees with the modern, and differs from the ancient version, which reads "generationes sunt xiv." in the three places.

The back of this leaf is altogether illegible.

The contractions used in this fragment are ih̄ for *Jesus* (*ver.* 1); ꝟ for *autem* (passim); ꝛe for *genuit* (*ver.* 16); (;) in uꝙ; for *usque*; and a line over e̅ for *em* (*ver.* 17). The only stop visible is that already noticed in *ver.* 3.

To the preceding addenda, it will not, I trust, be considered irrelevant to add a notice of an ancient seal of an abbot of the church in which the Domnach was preserved, and which has the appropriate device,—a figure of the patron saint holding a crosier with one hand, and a book, having a cumdach, or ornamented case, with the other. It is indeed not improbable that this seal was made for the very abbot, John O'Carbrie, by whom the outer cover was put on the Domnach; but on this point no conclusion is rested, as, unfortunately, the surname of the abbot is the only portion of the inscription difficult to be deciphered. It may, however, be remarked, that no other Abbot of Clones, having the Christian name of John, is found in the Irish annals, and that the style of the device and character of the letters on the seal belong to the fourteenth century, the period in which that abbot flourished.

The inscription is as follows:

SPRISIOHISVCCO-IRVABISDOMUSAPLORPPDECLVAIEOVS.

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Or with the words divided and the contractions lengthened, thus:

SIGILLUM PATRIS JOHANNIS V CCO-IRV ABBATIS DOMUS APOSTOLORUM PETRI ET PAULI DE CLUAINEOUS.

The matrices of this and another ancient seal of the clergy of the bishopric of Kilmore were found two or three years since in an island of Lough-Erne, and are now preserved in the British Museum.

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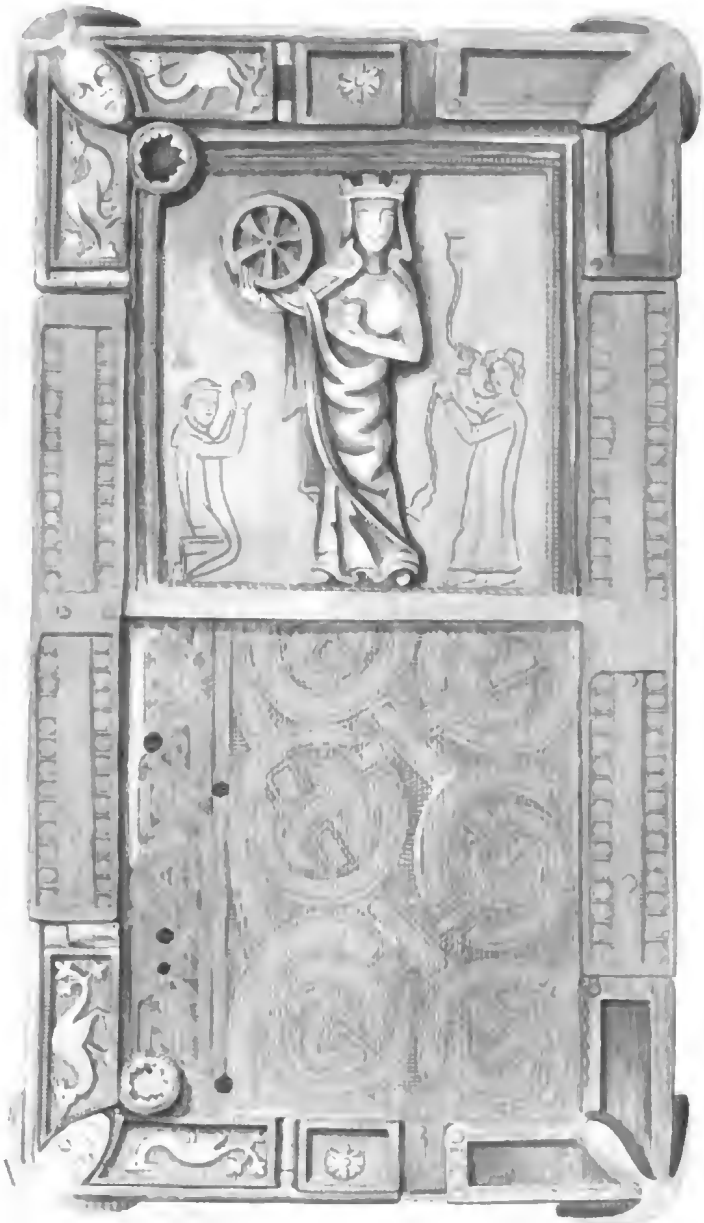

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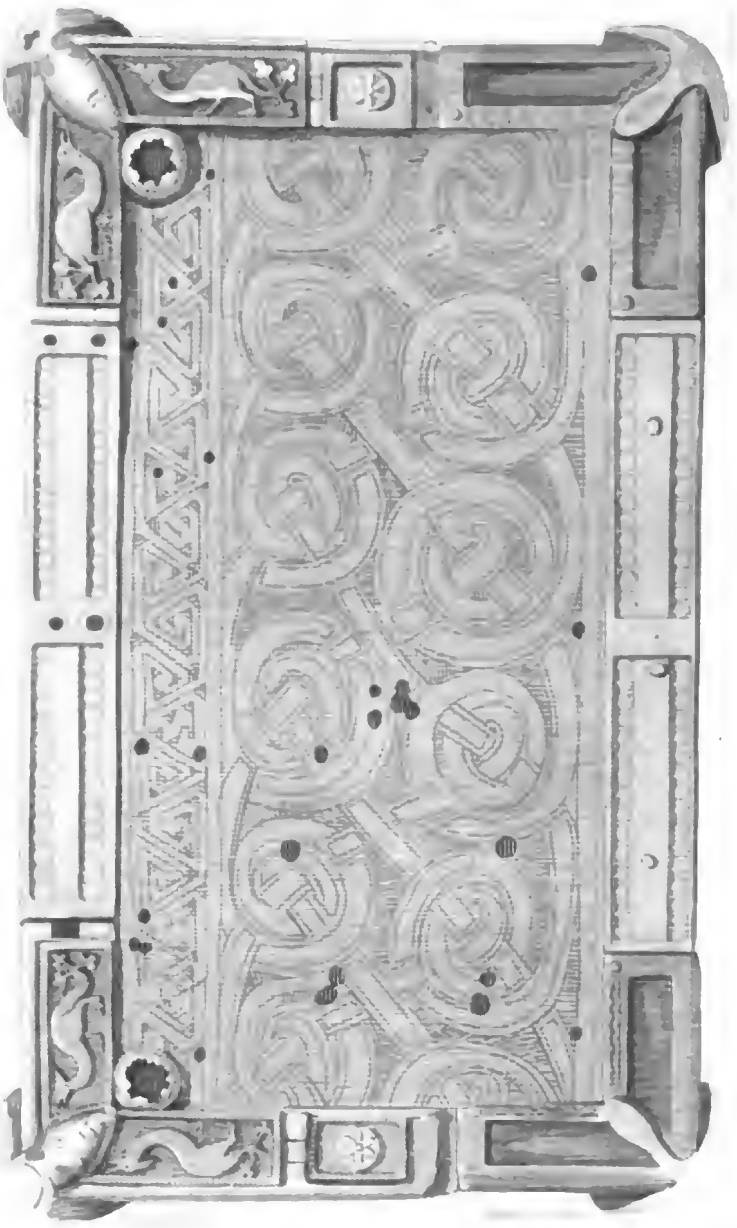

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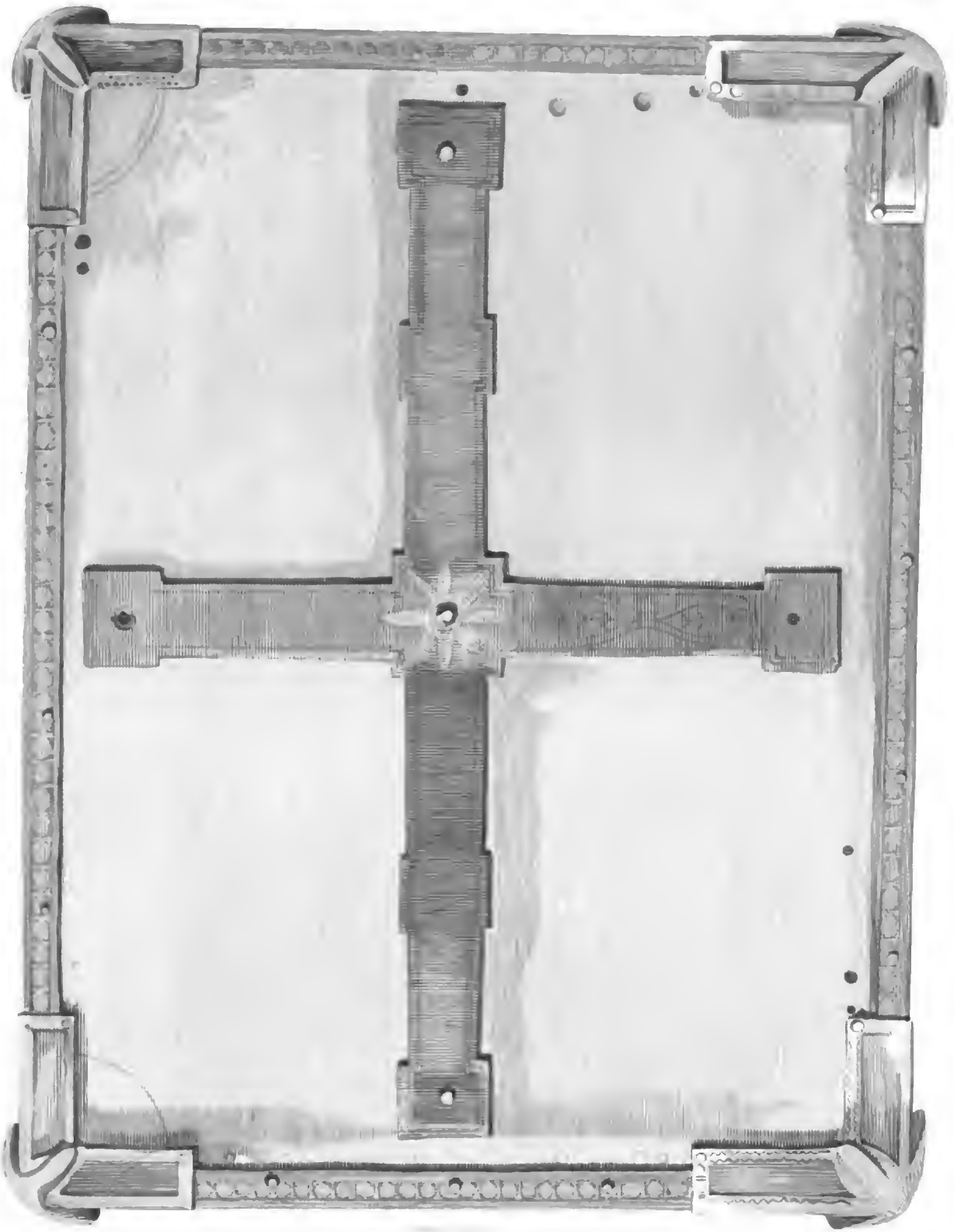

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III. *On the History and Antiquities of Tara Hill.* *By* GEORGE PETRIE, Esq., R.H.A., M.R.I.A.

Read 24th April, 8th May, and 22nd May, 1837.

THE Ordnance Map of the County of Meath being on the eve of publication, I am permitted by Colonel Colby to read to the Academy a portion of the memoir written to illustrate that map, which, from its importance to ancient Irish topography and history, can scarcely fail to excite a general interest, and at the same time to prove in a very striking manner the value and importance of the great national work of which it will constitute a portion.

The locality to which this paper relates is the well-known hill of Tara,—a spot which has been celebrated by native as well as foreign writers as the chief seat of the Irish monarchs, from the earliest dawn of their history down to the middle of the sixth century, at which period it was deserted. But though its ancient splendour has been the theme of most modern Irish antiquaries and historians, their labours have thrown but little light either on its past state or existing remains, and have made but little impression on the minds of the learned. Nor could a different result have been anticipated from careless and inaccurate notices of its ruins, and conclusions drawn from vague references to Irish authorities. The progress of the Ordnance Survey at length afforded an opportunity for a more satisfactory, because a more accurate investigation; and by a scientific plan of the remains at Tara, joined to an examination of such ancient descriptive notices of its former state as are still remaining, we are put into possession of all the information now likely to be obtained in any way leading to its successful illustration. Before, however, I lay the result before the Academy, it may not be uninteresting to give some detail of the mode of investigation adopted on this occasion.

The first step was to get all the existing vestiges laid down, according to measurement, on the map: this was done under the immediate direction of Captain Bordes, who had the charge of the Survey in the district.

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While this survey was in progress, a careful search was made in all the ancient Irish manuscripts accessible, for such documents of a descriptive or historical character as would tend to identify or illustrate these existing vestiges. The success which had already attended this mode of investigation in respect to the ancient fortress of the kings of Ulster on the hill of Ailcach, near Derry, led us in the present instance to anticipate an equally fortunate result, and we were not disappointed. In the same ancient Irish topographical work—the *Dinnseanchus*—in which the account of Ailcach was discovered, we found several ancient documents relating to this spot, some of which describe with considerable distinctness and accuracy the remains existing on Tara Hill at the periods of their composition.

The topographical tract which contains these interesting documents constitutes a portion of those invaluable miscellaneous compilations of ancient Irish literature, called the Books of Ballymote and Lecan, which our Academy are so fortunate as to possess. Other very ancient copies of this tract are preserved in the library of Trinity College, and in that of the Duke of Buckingham, at Stowe; and a transcript of one of the documents which it contains—the poem of O'Lochain,—is also preserved in our library in another work, namely, the *Leabhar Gabhala*, or Book of Conquests. This transcript, which is very valuable for its accuracy, is in the hand-writing of Peregrine O'Clery, one of the celebrated annalists called the Four Masters, and the best scribe among those industrious compilers. Of these previously untranslated and unvalued documents translations were made by Mr. O'Donovan, a gentleman eminently qualified for the task.

The map having been prepared, Captain Bordes, Mr. Larcom, and myself proceeded to the hill of Tara, where we called in the co-operation of Mr. O'Donovan, then employed on the Survey in the district, that we might have the advantage of his assistance in our endeavour to ascertain how far the various monuments still remaining could be identified with those anciently described. Our first labour was to go over the ground with the map, in order to be satisfied of its accuracy, and that no vestige of any ancient remain had been omitted. The propriety of this examination was soon apparent: in our progress many important features were discovered, not previously noticed, and which required the aid of antiquarian science to appreciate; and some interesting

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traditional information was obtained respecting objects now changed or obliterated. Till this task was completed we made no use of the written documents, lest we might be led into false or unwarranted conclusions from imperfect data; but having satisfied ourselves that we had omitted nothing, and distorted nothing to answer a theory, we commenced, with the map in hand, a second examination of the remains in the order pointed out by the ancient descriptions. This examination, fortunately, we were able to make with little difficulty, as the first object mentioned was one in the identification of which we could not be mistaken, namely, a remarkable spring, whose locality on the side of the hill is distinctly pointed out, and which is stated to be the source of a stream which turned the first watermill ever erected in Ireland.

Subsequently to this investigation several other historical documents, also tending to illustrate this interesting locality, were obtained, and are made use of in this memoir. They were chiefly found in the Book of Glendalough, in the library of Trinity College, and in the *Leabhar Breac*, or Speckled Book of Mac Egan, another compilation of Irish literature belonging to our Academy.

Having premised thus far, as to the mode by which the information was obtained from which our evidences have been derived, I now proceed to the notice of this interesting locality, as drawn up for the Survey.

The hill of Tara, though undistinguished either for altitude or picturesqueness of form, is not less remarkable for the pleasing and extensive prospects which it commands, than for the associations connected with it, as the site of the residence of the Irish monarchs from the earliest times. In both these circumstances it bears a striking similitude to the hill of Aileach, near Derry—the residence of the kings of Ulster—and to the hill of Emania, near Armagh, another residence of the Ulster kings, but who were of a different race. All these localities have shared a similar fate in the destruction of their monuments at distant periods, and all equally present striking vestiges of their ancient importance.

According to the Irish Bardic traditions, the hill of Tara became the chief residence of the Irish kings on the first establishment of a monarchical govern-

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ment in Ireland under Slainge, the first monarch of the Fir-bolgs or Belgæ, and continued so till its abandonment in the year 563.

> "Slainge ꝺFeaꞃaiḃ bolg co mblaṫ, gaꞃ tocbaṫ aꞃ tuiꞃ Teaṁaiꞃ."
> Slainge of the Fir-bolgs of fame (was he) by whom Temur was first raised.
> *Poem ascribed to Caoilte Mac Ronain in MS. T.C.D. Class H.* 1. 15. *f.* 58.

The Bardic history of Ireland states, that there reigned within these periods one hundred and forty-two monarchs, viz. one hundred and thirty-six Pagan, and six Christian. Of these, nine are stated to have been of the Belgic colony; nine of the Tuatha De Dannan; one hundred and twenty-three of the Scotic or Milesian; and one a Plebeian: and the time assigned to this interval, according to the corrected chronology of O'Flaherty, amounts to one thousand eight hundred and fifty-five years. Of the one hundred and thirty-six Pagan monarchs, and the manner of their deaths, O'Flaherty gives the following amusing summary:

> "Ex his porro 136, centum ferrum sustulit: septemdecim naturæ concesserunt: sex pestis absumpsit: tres fulmine percussi; et decem diversis aliis modis singuli e vivis excesserunt: unus quippe idolatriæ vitam devovit; alter membris dilaceratis extinctus, alius in patibulum actus; alius sine vi, sine morbo, sine coloris mutatione animam exhalavit; hic aquis obrutus; ille igni in cineres versus; animi mœrore confectus alius; alium equus quem regnum non valuit sessorem deturbavit; huic spina piscaria faucibus inhæsit, atque alium per artus serpens pessumdedit venenum."—*Ogygia*, pp. 420, 421.

It is not necessary to the subject of this memoir to enter upon any minute investigation of the truth of historical traditions referring to times so remote: they are adduced here solely as evidences of the extreme antiquity assigned by the Bards to Tara as a regal residence; and that this antiquity was really very great may, perhaps, be safely concluded from the notices of several of its ancient kings, given in the Annals of Tighearnach, which are now generally regarded by the learned as trustworthy. In these annals the name of a king of Tara occurs in the very first notice, as follows:

> "*In anno xviii. Ptolemæi initiatus est regnare in* Emain, Cimbaoṫ *filius* Fintain *qui regnavit annis xviii. Tunc in* Temaiꞃ Eachach buaꝺhach aṫaiꞃ Ugaine."

> In the eighteenth year of Ptolemy, Cimbaoth, the son of Fintan, began to reign in Emania, who reigned eighteen years. Then in Temur, Eochy the Victorious, the father of Ugony.

The commencement of the reign of Cimbaoth, the seventy-fifth monarch of the Irish lists, which is assigned to the year 305 before Christ, is the period which Tighearnach regards as the limit of authentic Irish history: "*Omnia*

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monumenta Scotorum ante Cimbaoch *incerta erant.*" But though the authority of Tighearnach may seem sufficient to establish a very great antiquity for Tara, it is not to be inferred that it was at all times the seat of the monarchy, or that every thing related of its royal occupants preceding the known use of letters in Ireland has a foundation in truth. On the other hand, however, it would be equally premature to reject these traditions as wholly fabulous, as to receive them as real history, until the whole body of evidence contained in the Irish MSS. shall be subjected to critical examination, by being laid before the public with literal translations. In the mean time, without collecting all the matter relating to the history of Tara, which would in fact be nothing less than a history of Ireland, it will be necessary, for the satisfaction of the reader, and the completeness of this memoir, to bring forward the notices of the more remarkable events in connexion with its early state, whether apparently authentic or apocryphal, without minutely canvassing their claims to credibility. And for facility of reference, these notices will be given as often as possible from the published Annals of Tighearnach, Ulster, and the Four Masters.

It is stated in the Annals of the Four Masters, from the Book of Clonmacnoise, that Ollamh Fodhla, the fortieth monarch of Ireland, according to the lists, first instituted the triennial assemblies, and erected the *Mur Ollamhan*, or House of *Ollamh*, at Tara.

Aoir doṁain, epi ṁile naoi ceec ricé ado. Iap mbeiṫ da richeṫ bliaḋain i rṡé Ereṁn o 'Ollaṁ Foéla aṫbail ma ṁur buḋein i Teṁraiṡ. Ar e ceuna pi lar a noepnaṫ réṫ Teaṁrach, acur ar lair do cóṫbaṫ mur n Ollaṁan i n Teṁraiṡ. Ar e sin no oṫaiṡ eaoiriuch ar gach epiochaiṫ ceṫ, acur bṗúgaṫ ar gach baile, acur a bṗoġnaṁ uile do ṗiġ Ereṁn. Eochaiḋ ceṫ ainm Ollaṁan Foéla, acur ar aire ad ṙubraṫ Ollaṁ ṗṁ, ar a beiṫ 'na Ollaṁ erġna céṫur acur 'na ṗiġ Ereṁn iaṁaiṁ.

A. M. 3922. Ollamh Fodhla, after having been forty years in the government of Ireland, died in his own house at Temur. He was the first king by whom the Assembly of Temur was instituted; and it is by him that *Mur Ollamhan* was erected at Temur. It is he also that appointed a chief over every barony, and a farmer over every townland, and who were all to serve the king of Ireland. Eochaidh was the first name of Ollamh Fodhla, and he was called Ollamh from his having been first a learned *Ollamh* (chief poet), and afterwards king of Ireland.

On this passage it may be remarked, that though the date assigned to the foundation of these institutions is so very remote, as to make it appear wholly incredible, yet there is the testimony of Tighearnach that a monarch known by

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this cognomen did really exist; and the ancient lives of St. Patrick, as well as the authentic annals, sufficiently prove that triennial assemblies at Tara, whatever may have been the exact time of their institution, had certainly existed from a very remote period preceding the introduction of Christianity.

It must be confessed also, that the doubts created by the great antiquity assigned to Ollamh and his institutions have been considerably increased by the pompous amplifications given by the most learned modern Irish antiquaries of the simple records of the original annalists. It is not easy to read without incredulity the following passage from O'Flaherty, which may serve as an example of this amplification:

"Ipse literis apprimè excultus Ollamh-Fodla, .i. per Hiberniam quæ Fodla lingua nostra dicitur, præcipuus literarum professor (cui Achaio prius nomen datum) ob insignem literaturæ peritiam meruit appellari. Qui ad promovendum etiam literarum studium Mur-Ollamhan, i. Doctorum murum Temoriæ erexit. Gymnasium, Canopum, Prytaneum, Academiam, vel Lyceum dicas; de quibus ultimis accipe hos Ciceronis versus:

"Inque Academia umbrifera, nitidoque Lyceo
Fuderunt claras fæcundi pectoris artes."—*Ogygia*, p. 214.

By a reference to the passage previously quoted from the Four Masters, on which this evidently rests, it will be seen that the only foundation for a belief in the existence of this college or Lyceum, is an etymological inference from the name of the house or *mur*, in which Ollamh Fodhla died, a name which, when translated grammatically, can have no other meaning than the House of Ollamh himself, as the genitive singular form of *Ollamh* is *Ollamhan;* and it is thus understood by Keating, who has not a word about the college of the *Ollamhs*, or Professors, but simply states that Ollamh Fodhla died in his own house (ɪnɑ ṫɪġ ꝼeɪn).

In like manner, the late Irish lexicographer, Edward O'Reilly, in his Essay on the Brehon Laws, translates the following passage in the *Leabhar Gabhala*, or Book of Invasions:

Aꝛ é ceonɑ ꝓɪġ laꝛ ɑ noeaꝛnaò ꝼeꝛ Teaṁꝛach ɑ muɪꝛ Ollaṁaɪn ɪ tTeaṁꝛaɪġ, &c.	He was the first king by whom was held the Feis of Tara in the College of Professors.—*Transactions of Royal Irish Academy*, vol. xiv. p. 147.

The same writer elsewhere (*Irish Writers*, p. xv.) states, that the laws promulgated by this monarch, Ollamh Fodhla, are quoted in Cormac's Glossary, a work of the ninth century; but on a careful examination of that work, it has been found that this assertion is not true.

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The oldest authority for this name, *Mur Ollamhan*, is a poem in the *Leabhar Gabhala*, ascribed, though erroneously, as its language shews, to Ferceirtne, a poet of the first century; but this poem gives no stronger evidence of the meaning ascribed to the name than the passages already quoted:

Ollaṁ Fodla feóchair gal	Ollamh Fodhla, of brave fight,
Do rorainn múr n-Ollaṁan	Erected *Mur Ollamhan;*
Cetna rí ruana co rath	The first king, powerful with prosperity,
Lar andearnad Fér Teamrach.	By whom was established the *Fes* of Temur.

It will be seen hereafter that the *Mur Ollamhan* is not mentioned among the vestiges described by the ancient topographers; and indeed there is every reason to believe, that it had no existence save in the etymological inference of O'Flaherty, as the older writers do not appear to have understood the name in the sense stated by him.

Of the nature of the *Feises*, or triennial meetings, perhaps the most ancient authentic record is that preserved in the following poem, quoted by Keating, who ascribes it to Eochaidh O'Flynn, a poet who died in the year A. D. 984:

Feis Teaṁrach gach treas b̓liaġain	The *Feis* of Temur each third year,
Do ċoṁall reaċt is riaġail	To preserve laws and rules,
Do ġniċi ann sin go teann	Was then convened firmly
Ag riogaib aṁra Eireann.	By the illustrious kings of Erin.
Do riġne Caṫaoir cleaṁnach	Cathaoir of sons-in-law convened
Feis roċadṁ na riġ-ṫeaṁrach	The beautiful *Feis* of regal Temur;
Tangadar leis, feirrde ḋe,	There came with him (the better for it)
Fir Eireann go haonb̓aile.	The men of Erin to one place.
Tri lá ria Shaṁuin do ġreas	Three days before *Saman*, always,
Tri lá na diaiġ fa ḋéiġb̓éas	Three days after it—it was a goodly custom—
Do'n tsluaġ ro buḋ diomór dóiġ	The host of very high fashion spent,
Ag siorol ris an seaċtṁoin	Constantly drinking during the week.
Gan ġoid, is gan ġoin duine,	Without theft, without wounding a man
Aca a n-uireas sin uile,	Among them during all this time;
Gan imirt airm, gan alaḋ,	Without feats of arms, without deceit,
Gan eaċraḋa d'iomraḋa.	Without exercising horses.
Gíbe do ġníḋ níḋ diob̓ sin	Whoever did any of those things
Fa bíoḋb̓aḋ troċ go dtroimniṁ,	Was a wretched enemy with heavy venom;
Ni geab̓ta ór i rann uaiḋ	Gold was not received as retribution from him,
Aċt a anam re haonuair.	But his soul in one hour.

Haliday's Keating, p. 330.

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Passing over a long series of monarchs, of whom nothing very important is recorded in connexion with this subject, the attention is next arrested by the notices in the annals respecting the reign of Tuathal *Teachtmar*, or Tuathal the Acceptable. Of this remarkable epoch in Irish history the following brief notices are given in the Annals of Tighearnach.

128. Fiacha Findolaiḋ *interfectus est in Temoria, vel* a Muig bolg *ut alii aiunt,* o Elim Mac Conrach, .i. o rig Ulaḋ, *qui cecidit* hi cath la Tuathal Teachtmar a noigal a athair.

130. Tuathal Teachtmor *regnavit, annis xxx.* Is he cetna ro naisc Borum Laigen agus is ris ro iacaḋ ar tus.

160. Tuathal Teachtmar *occisus* la Mal Mac Rochraiḋe, La Ri n-Ulad oc lind an gabund in Dail araiḋe.

128. Fiacha Findolaidh was slain at Temur, or, as others say, at *Maghbolg*, by Elim Mac Conrach, that is, by the King of Ulster, who [afterwards] fell in a battle by Tuathal Teachtmar in revenge of his father.

130. Tuathal Teachtmar reigned thirty years. He is the first who exacted the *Borumh* (Boarian mulct) of Leinster, and it is to him it was first paid.

160. Tuathal Teachtmar was slain by Mal Mac Rochraidhe, King of Ulster, at *Linn-an-gabunn* in Dalaradia.

In these notices there is nothing likely to be untrue; but the Annals of the Four Masters, besides their usual difference in dates, add to the simple facts of Tighearnach some particulars from the Bardic poems not so easy to be credited; and, as in the case of Ollamh Fodhla, already noticed, the modern historians, as Keating, Lynch, O'Flaherty, and O'Conor, have collected so much minute historical details as must excite considerable doubts in the minds of unprejudiced readers, until their claims to authenticity shall be tested by a severe critical examination. The reign of Tuathal Teachtmar is the great epoch at which, according to Charles O'Conor, the history of Ireland becomes as well minute as accurate; and, indeed, it must be confessed that it presents but little inconsistent with the laws of historical probability: but as it would be wandering too far from the object of this inquiry to examine those details, except as far as they immediately relate to Tara, it is only necessary to cite the following particulars from the Bardic history, as given by the historians already referred to.

1. That Tuathal, after having obtained possession of the crown, proclaimed a convention at *Tara*, to which the princes and nobility of the kingdom repaired, and at which they all swore by their heathen deities, the sun, moon, and all the other celestial and terrestrial divinities, that they and their posterity

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would maintain an inviolable attachment, subjection, and obedience to him and his posterity as kings of Ireland, as long as Irish soil should be surrounded by the sea. 2. That he formed the territory of Meath by a union of four portions from the four provinces, as mensal lands for the support of the monarchy. 3. That in three of the four portions thus united solemn assemblies were held every year, one at *Tlachtga*, in the Momonian portion, on the last day of October, celebrated by night to appease the local gods, through the ministry of the Druids, by immolating victims and lighting fires; another on the first of May, at *Uisneach*, in the Connaught portion, for the sale of merchandizes; and the third at *Tailteann*, in the Ultonian portion, about the first of August, to contract marriages by the consent of parents and friends. And 4. That in the fourth, or Lagenian portion, namely, Temur, a convention was held every third year for the administration of public affairs. In addition to these, Keating further adds, that Tuathal erected *longphorts*, or fortified habitations, at these four places.

With regard to these statements, as the writers last referred to give no authorities for them, it is not easy to determine how far they may be true or otherwise. But for the summoning of the princes and nobles of Ireland to Tara by Tuathal, their swearing by the objects of their pagan adoration to be faithful to him, and the formation of the territory of Meath, as mensal lands for the support of the monarchy, very ancient authorities are found in all the copies of the *Leabhar Gabhala*, or Book of Conquests.

Ir la Tuathal era do dichcheannadh each coicead in Erinn, conad de a derar Mide ria .i. Meidi cacha coicid, no, ir o Midi, mac Bratha a derar, *unde dicitur* midi. Do gab era Tuathal rigi roithrén ferammail for Erinn, ear éir a danair acus ourbtibad do ferib. Do rondad era Féis Temrach la Tuathal Techtmar iarsain, acus tancadar coicedaich Erenn na chomhdail co Temraid. Ir iad ro imorra na coicedaich thanic ano .i. Fergus Febal acus Eochaid Mac Conrach i compigi for Ulturb, acus Eogan, Mac Aililla Eran, for Desmumain, acus Conrach Mac Derg

"It was by Tuathal that every province in Ireland was *decapitated* to form Meath, which was thence called *Meidhe*, that is *neck*; or, it was called from *Midi*, son of Bratha. Tuathal assumed a mighty and manly reign over Ireland, after having cut off its *Danars* and enemies. Tuathal Teachtmar afterwards convened the *Feis* of Temur, and the provincialists came to him to Temur. These were the provincialists who came thither, viz. Fergus Febal and Eochaidh Mac Conrach [who were] in the joint government of Ulster, and Eogan, the son of Ailill Eran, over Desmond, and Conrach Mac Derg over the Connacians, and Eochaidh Mac Dairi over great

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for Chondaćtaib, acus Eochaiḋ Mac Dairi, for Mumhain moir ocus Eochaiḋ Mac Eachach Doimlén do Domnannchaib, for Laigniḃ. Ro gob som tra ratha greni ocus esca ocus cach cumachtaich fil for nim ocus for talmain, ciamdais coimnert coiceḋaich Ereno, conaptais coimnert fri a cloind sin co brath.

Munster, and Eochaidh, the son of Eochaidh Doimhlen of the Damnonii, over Leinster. These then swore by the sun and moon, and by every power which is in heaven and on earth, that even though the provincialists should be able, they would never contend with his descendants."—*Leabhar Gabhala, in Book of Lecan, fol.* 296.

The word *Danar* in the above extract, which literally signifies *Dane*, but is there figuratively used, as it is to the present day, to denote a cruel person, a foreigner, shews that the prose part of this work was compiled after the Danish ravages in Ireland; yet as several MSS. of it of the twelfth century exist, its antiquity cannot be brought lower than that age, while the poems which it quotes as authority are usually some centuries earlier. The poems given for the events of Tuathal's reign are the compositions of Maelmura Othna, a distinguished poet and historian, who was Abbot of Fahan, in the County of Donegal, and who, according to the Annals of the Four Masters, died in 884. They are quoted by O'Duvegan, who died in 1372, from King Cormac's Psalter, written, as it is believed, before the year 900.

In one of these poems the form of the pagan oath of the Irish Chiefs, as recorded to have been sworn on this as well as on other important occasions, is more minutely stated than in the prose; and as this is perhaps the most ancient authority in which it is found, and as it has never been hitherto published, it is here given with a literal translation.

Ate ratha ro gob Tuathal,
Tren fri tobach,
Nem, talam, grian, esca ioan,
Muir, tir torad,
Cosa, lama, beoil im theangta,
Cluasa, suile,
Echroit, gai, sceith, cloidim croda,
Co na n-duire,
Dreacha daine, druct la daithgen,
Traig la tuili;
Ith, blict, mes, cać maiṫ ar ćena
Fo gni duini.
Do rasad uili na ratha,
Sin iar n-dligeo,

These are the sureties which Tuathal took,
Mighty at exacting,
Heaven, earth, sun, pure moon,
Sea, fruitful land,
Feet, hands, mouths with tongues,
Ears, eyes,
Horses, javelins, shields, valiant swords
With their hardness,
Countenances of men, dew with colours,
Strand with flood;
Corn, milk, fruit, each good likewise
Which man doth.
These sureties all were given,
According to law,

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Fri cloinn Tuathail, ir fri chenel,
Ir fri cineadh,
Airer mairer muir im Erinn,
Himdiu nuaidi,
Co na coimenai Temair eriaidi
Re cloinn Tuathail.

To Tuathal's children, to his race,
And to his tribe,
While the sea exists around Erin,
Insulated, solitary,
That the lordly Temur would not be defended
Against Tuathal's children.

But for the other statements no authority older than Keating has been found; and it will be seen hereafter that no monumental memorial of the era of Tuathal existed at Tara in the time of the poets by whom its ancient remains are described.

At the year 218, Tighearnach records the commencement of the reign of Cormac Ulfada, the grandson of Con of the Hundred Battles, and commonly called Cormac O'Cuinn and Cormac Mac Art. As the reign of this monarch is the epoch at which most of the monuments remaining at Tara had their origin, and as the circumstances recorded of his life bear, with few exceptions, the stamp of true history, it may be desirable to present to the reader a more ample detail of them than it was deemed necessary to give of those recorded as distinguishing the lives of his predecessors. As a chronicle of these events the Annals of Tighearnach are selected as the most authentic authority.

A. D. 218. Cormac Ulfada, hua Cuinn, *regnat annis xlii.*

222. Kl. Cath Granaird, ria Cormac hua Cuinn, fon Ultaibh. Cath Medha fon Connachtaibh. Cath Anaeith, cath Cinndoire, cath Srutha fon Ultaibh. Cath fri Gcul Cuilgne.

K. *iii.* Cath Atha Beitheach, cath Ratha Duine.

K. *v.* Cath Chuile Tochair fo tri, ocus tri catha a nDuibfidh.

K. *vi.* Cath Allamuigh, ocus *vii.* catha Eillne.

K. *vii.* Cath Muige Techt. Loingeas mor Cormaic Mic Airt esan maigh fein fri se seotha mbliadhan.

Kl. *i.* Ceithre catha fon Mumhain la

218. Cormac Ulfada, the grandson of Con, reigns forty-two years.

222. The battle of *Granard*, by Cormac Ua Cuinn, against the Ultonians. The battle of *Medha* against the Connacians. The battle of *Anaeith*, the battle of *Cinndoire*, the battle of *Srutha*, against the Ultonians. The battle of the pass of *Cuailgne*.

The battle of *Ath Beitheach*, the battle of *Rath Duine*.

The battle of *Cuil Tochair* three times, and three battles in *Duibhfidh*.

The battle of *Allamuigh* and the seven battles of *Eillin*.

The battle of *Magh-Techt*. The large fleet of Cormac Mac Art over the sea for the space of three years.

Four battles by Cormac against the Momo-

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Cormac, cath Beirre, cath Locha Lein, cath Luimnig, cath Greine for Mumhain beous. Cath Clasaigh, cath Muirisc, cath Ferta, a torchair Eochaid Taebhfhada Mac Aillila Uluim, cath Aird caim. Ocos orgain na ninghen is in Claenferta a Temraig la Dunlaing mac n-Enda Niadh Righ Laighean. .i. xxx. righinghen ocos c. ingen la gach n-ingin dibh. xxx. ar ccc. uile sin. Da rig dec ro bith Cormac iarom do Laighnibh ar galaibh aen fir, ocos fonaidm na Borumha co na tormach lais.

nians, the battle of *Beirre*, the battle of *Loch Lein*, the battle of *Luimneach*, the battle of *Grian*, likewise against the Momonians. The battle of *Clasach*, the battle of *Muirisc*, the battle of *Ferta*, in which was killed Eochaidh of the Long Side, the son of Aillil Olum, [and] the battle of *Ardcam*. And the slaughter of the daughters [girls] in the *Claenferta*, at Temur, by Dunlaing, the son of Enda Niadh, King of Leinster, i. e. thirty royal daughters and one hundred daughters with each daughter of them. Thirty and three hundred was the entire number. Cormac put to death twelve kings of the Lagenians for the deed of one man, and the *Borumha* was exacted by him with an increase.

Kl. *iii.* Cormac hua Cuind dathrighadh o Ultaibh.

Cormac Ua Cuinn was deposed by the Ultonians.

236. *Bellum* ocFothaird Muirtheimne. Mebuig re Cormac hua Cuind, ocos re Fiachaig Muillethon, Righ Mumhan, for Cruithniu, ocos for Fiachaig Araidhe, *ubi et ipse cecidit ut alii aiunt.*

236. A battle at *Fothaird Muirtheimne* [Faghard]. The defeat was given by Cormac Ua Cuinn and Fiacha Muillethan, King of Munster, to the Cruthni and Fiacha Araidhe, where he himself [i. e. Fiacha Araidhe] fell, as some say.

248. K. *ii.* K. *iii.* Teasbhaidh Cormaic hui Chuind fri re vii. miss.

The expulsion of Cormac Ua Cuinn for the space of seven months.

K. *iiii.* Aithrighadh Cormaic hui Chuind o Ultaib iarom.

Cormac Ua Cuinn afterwards dethroned by the Ultonians.

Cath Crinda Bregh ria Cormac ocos ria Tadg mac Cein mic Aillila Uluim, co n-a trichad rig ocos co n-a caecad cathmile ocos co n-a sluag diarmide ar cena, ocos ria Lugaid Lagha mac Mogha Nuadhat for Ultaib, a torcratar na tri Ferguis .i. Fergus Foltleabair, ocus Fergus Cairfiaclach, ocos Fergus Duibdetach, las in aen oclach, la Lugaid Lagha, co tuc lais a tri cindu co ro taiselb do Cormac a n-eraic a athar .i. Airt mic Cuind, ro bith som a Muig Mucruime. Ocos ro brir Tadg iiii. catha is in aen lo sin .i. cath Conachaigh, ocos cath Sithbe, ocos cath Droma Fuaid, ocos cath Cairge Eolairg.

The battle of *Crinna*, in Bregia, by Cormac and Teige, son of Cian, son of Oilioll Olum, with his thirty kings, fifty heroes, and innumerable forces also, and by Lugaid Lagha, son of Mogha Nuadhat, against the Ultonians, in which (battle) fell the three Ferguses, viz. Fergus of the Long Hair, and Fergus of the Crooked Teeth, and Fergus of the Black Teeth, by the one young hero, Lugaid Lagha, who brought their three heads and presented them to Cormac as *Eric* for his father Art, the son of Con, who had been killed in *Magh Mucrime*. And Teige gained four battles on that one day, viz. the battle of *Conachaigh*, the battle of *Sithbe*, the battle of *Druim Fuaid*, and the battle of *Carraig Eolairg*.

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Iarr na cathaib do breach Taog ani do eimchill feoh a carpad do muig Breg[h] o ro mebuigh in cach co hairdchi. Ireo om do chimchil Tricha ced Cianachta, o glair nepa co cnoccaibh Maile doaigh, ic abuno Life.

After the battles Teige obtained as much of the plain of Bregia as he was able to surround with his chariot from the time the [last] battle was gained till night. What he then surrounded was the *Tricha ched* of *Cianachta*, [which extends] from *Glaisnera* to the hills of *Mail Doaith*, which are at the river Liffey.

251. Cath Crinna Fregabail, ria Cormac Ua Cuino, for Ulcaib, *ubi cecidit* Aengus Finn mac Fergusa Duibdeadg, co n-ár Ulad.

251. The battle of *Crinna Fregabail*, by Cormac Ua Cuinn, against the Ultonians, in which fell Aengus Finn, the son of Fergus of the Black Teeth, with the slaughter of the Ultonians.

254. Inoarba Ulad a h-Erinn a Manainn, la Cormac hua Cuino. Ar de ba Cormac Ulfada ota ro cuir Ulcu a fad.

254. The expulsion of the Ultonians from Ireland to *Manann*, [the Isle of Man] by Cormac Ua Cuinn. It is thence he was [called] Cormac Ulfada, because he drove the Ultonians afar.

K. *i.* Gum Chellaig mic Cormaic, ocus marbadh Setna mic Blae mic fechtaire na Tempach. Ocus fuil Cormaic hui Chuino do brigeb do den forgum la h-Aengus mac Fiacha Suigi, mic Feidhlimid Rechtmair, *unde* Aengus Gabuaibteach *dictus est.* Ro brig iarom Cormac iii. catha for na Deisib, conus fai a Mumain, ocus co ro tarmo arr a cin.

The wounding of Ceallach, the son of Cormac, and the killing of Setna, the son of Blae, son of the lawgiver of Temur. And the eye of Cormac Ua Cuinn broken with one blow by Aengus, the son of Fiacha Suighi, the son of Feidhlim Rechtmar, whence he was called Aengus Gabhuaibhteach, [i. e. Aengus of the Dreadful Spear]. Cormac afterwards gained four battles over the Desii, so that he drove them into Munster, and expelled them from their [original] country.

Kl. *iii.* Cormac hua Cuino cec catharg do ec a Cleitech ota maire, iar leanmain cnama bradain ina bragaid, no, ar iad na siabrada ro n-orcaigh, iar na brath do Maelcinn Draoi, o nar creo Cormac do.

Cormac, the grandson of Con of the Hundred Battles, died at *Cleiteach*, on Tuesday, the bone of a salmon having stuck in his throat; or, it is the sheevree [genii] that killed him at the instigation of Maelcinn, the Druid, as Cormac did not believe in him.

It is scarcely necessary to observe, that these details have all the marks of authenticity; nor is it necessary to their credibility to concede to the Irish of those times the use of letters, as oral tradition alone would have been sufficient to preserve such meagre details until the introduction of Roman literature with Christianity into Ireland in less than two centuries afterwards. Whether the Irish had or had not the use of letters anterior to this epoch is, at the same time, a subject open to investigation; but it would be foreign from the purpose of this memoir to enter upon an inquiry so laborious; it is sufficient to observe,

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that no fact can be more incontrovertibly established, than that the Irish committed to writing, in their native language, immediately after the introduction of Christianity, not only the laws, bardic historical poems, &c., of their own time, but those which had been preserved from times preceding, whether traditionally or otherwise. Till this point, however, be determined, much of the matter stated by the later annalists in connexion with Cormac and his times will necessarily be received with suspicion by the learned, as in the additional details given in the following passage, recording the death of Cormac in the Annals of the Four Masters:

A.D. 266. Ceithracha bliadain do Chormac Mac Airt mic Cuinn hi righe n-Erenn, go bruair bar i g-cletty, iar leimain do éasg bradain ina bragait, trer an fiadhrad ro imir Mailgenn Drai fair, iar n-iomrod do Chormac ar na draoidibh ro bidin adarca de do tairrib; conad aire sin ro aimrig diabal eirium tre furailean na noruad, go n-tuc bar n-eochra do. Ar e Cormac do érailc teagusc na rig, do coimed mod, ber, agus follamnuighe na righe. Uaduar oirdherc eirighe i noligedh, hi ccoimgnimh agus hi senchus; ar ar e ro fiol neache, riaghail, agus airgiatha gacha haoi, agus cecha cairgne iar ccoir: conad e a oligthe ro fhaic for each dach daoi for congbail leo gur an aimsir freacnairc.

Ar e an Cormac ro mac Airt beor ro éinoil Croinice Erenn co haonmaighin go Temraig, gur ro forcongair forra Croinic Erenn do scribad i n-énliubar, dar do h-ainmFlaitsTemrach. Da hisin liubar sin basar coimgneda agus comaimsira rioghraidhe Erenn fri rioghaibh agus Impiridhibh an Domain, agus sloghadha na gcoicced fri rioghaibh Erenn. Da hann dan ro sgribad ina noligthi ri Erenn do na Coicceadaibh, agus cfor, agus oligthi na gcoicced o a fomaimgee o cha uasal co hirisal. Da hann sin daoi crioch agus corann Erenn or ino or,

A. D. 266. Cormac, the son of Art, the son of Con, after having been forty years in the government of Ireland, died at Cletty, the bone of a salmon having stuck in his throat, through the Sheevra, whom Mailgenn, the druid, induced to attack him, after Cormac had turned from the druids to the adoration of God; wherefore a demon attacked him at the instigation of the druids, and gave him a painful death. It is Cormac who composed the *Teagasc na Riogh*, to preserve manners, morals, and government in the kingdom. He was an illustrious author in laws, synchronisms and history; for it is he that promulgated law, rule and regulation for each science, and for each covenant according to justice: so that it is his laws that restrained all who adhered to them to the present time.

It is this Cormac Mac Art also that assembled the chroniclers of Ireland together at Temur, and ordered them to write the Chronicles of Ireland in one book, which was called the Psalter of Temur. It was in that book were [entered] the coeval exploits and synchronisms of the Kings of Ireland with the Kings and Emperors of the world, and of the kings of the provinces with the monarchs of Ireland. It was in it was also written what the monarchs of Ireland were entitled to receive from the provincialists, and what the provincialists [i. e. provincial kings] were entitled to receive from their subjects from the noble to the subaltern. It

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o cha coicceō co cuarch, o chuarch co baile, agur o baile co craiġió oo éir. Oipoerc na neiéiri i leabar na h-Uiöri. Ar rollur ann i leabar Oinnrenchura.

was in it also were [described] the bounds and meres of Ireland from shore to shore, from the province to the territory, from the territory to the bally, (townland,) and from the bally to the *traigid* of land. These things are conspicuous in *Leabhar na h-Uidhri*. They are also evident in the *Leabhar Dinnshenchusa*.

This detail, it must be confessed, has but little agreement with the meagre and unsuspicious account given by Tighearnach. On every thing stated by the Four Masters the earlier annalist is silent, except the notice of the cause of his death, and even in this what is doubtfully put by the one, is made positive by the others. Whether, however, those details be true or false, or in whatever degree they may be so, it is due to the character for veracity of the Four Masters to mention, that they found what at least appeared to them sufficient evidence upon which to ground their statements, in very ancient documents. The additional facts of importance stated by the Four Masters are three:—1. That Cormac was the author of the ancient tract called *Teagasc na Riogh*, or Instruction of the Kings. 2. That he was the author or compiler of laws which remained in force among the Irish down to the seventeenth century. And 3. That he caused the ancient chronicles of the country to be compiled in one volume, which was afterwards called the Psalter of Tara. On each of these facts a few remarks may be permitted.

1. The work called the *Teagasc Riogh* has been ascribed to Cormac by the Irish universally from a very remote period, and whether it be his or not, it is certainly one of the most ancient and valuable documents preserved in the language. The following verse of an ancient poet is a good authority for this statement:

Cormac ðreiéeiñ na mbreé rir,	Cormac Brehon of true judgments,
Θ oo éraiée Teéaire na Rīġ;	Composed the Instruction of Kings;
Ni raġéan uġoar ir fepp	No better author is found
Cir ólġéib aerpa Eirenn.	Upon the aged laws of Erin.

In an ancient manuscript in Trinity College library (Class H. 1. 15. p. 149.) it is stated, that it was the custom at the inauguration of the Irish chiefs to read the *Teagasc Riogh* and the Laws of Cormac; and this statement is corroborated by a passage in the Annals of the Four Masters recording the death of an Irish

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chief, in which it is stated that he governed his subjects by the *Teagasc Riogh* and the Laws of Cormac.

It must be confessed, however, that it was the opinion of the venerable Charles O'Conor of Belanagare, that this work "should not be considered as the composition of King Cormac, but as the epitome of some writer of an ulterior age." But it would seem more probable that the work, as at present preserved, is rather an amplification than an epitome of the original work, of which he is supposed to be the author.

Copies of the *Teagasc Riogh* are preserved in the Books of Glendalough and Ballymote, and translated specimens will be found in the *Dublin Penny Journal*, vol. i. pp. 213, 214, 215, and 231, 232. The whole would be well worthy of publication, as affording probably the best evidences now to be obtained of the wisdom and amount of civilization current among the Irish in very distant times.

2. As the institutor of laws the claims of Cormac appear to stand on a firmer basis than his title to the authorship of the *Teagasc Riogh*. Several tracts of his laws are preserved in MS. in our public libraries, and they are quoted in Cormac's Glossary, an undoubted work of the ninth century. The most perfect copy of these laws, as explained and enlarged by Cennfaela, a writer whose death is recorded in the Annals of Tighearnach, at the year 679, is preserved in a MS. supposed to be of the fourteenth century, in the library at Stowe. A very interesting dissertation upon the contents and age of this MS. will be found in the Stowe Catalogue, by the late Dr. O'Conor, and, as this Catalogue is of extreme rarity, a few extracts from that dissertation are here given.

"*Description of the MS. of Brehon Laws now before us.*

"On the first leaf, Cennfaelad states that this work consists of two parts. The first is—'*Cuid Cormaic mc Airt Righ Eir*—The part composed by Cormac, the Son of Art, King of Ireland; the second is—'*Cuid Cendfaelaid mc Ailill*—The part composed by Cenfaelad, 'the Son of Ailil.'

"Cenfaelad's part consists chiefly of a gloss on the law terms used by Cormac; but this gloss is of the seventh century, the law terms of which are as unintelligible now as those of the third century were then. He adds that Cormac composed his part at *Acill*, near Temora, after he had resigned the sovereignty to his son Carbre. We have already seen that Cennfaelad was a writer of the seventh century, and that Acil was one of the Royal residences of Meath.

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" The first words of this fragment are—

" 'In ainm de fo—Locc don liubhappa daire lubran 7 aimsir do aimsir domnaill mc. aeda mc. ainmireach 7 fesra do cenofaela mc. aill. 7 esc. a denma a hinsin desmaic do be in acenn chinofaela ik. maighe rath.

" 'Ceofa buaiha in k.a fin .i. maimo ar congal claen in a gae fian domhnall in a fhirinde 7 fuibhne geile dodul re geleathe 7 ainsinn desmaic do be in acino cinofaela ik. Maighe Rath.

" 'Ise in ^{a}f aithesbuaidh maimo ar congal in a gae fen domnall inafirinde, uair buaidh maimo aiin anfiren fiar an firen.

" 'Ise in ^{a}f. aithesbuaidh fuibne geile do dul re geleathe .i. ar ar facaibh do laighibh 7 doifgelaibh agarfiseach orimille.

" 'Is e an ^{a}f aithesbuaidh ainsinn desmaic do bein acino cinofaela uair is ann do righneo a leigar seuaim orecain scompac naeri fraitheo se. eighibh naeriruaidh .i. fairesechair 7 fairilechea 7 failesgino 7 doneochpochanoair naeriresola canlai fo bidh aiceriun eriagerse ainoclechea cannaighche 7 ineoch bohineair feneo ler de fob. eohglunfraithe fui 7 fo ferifbhcha aice scaile liubhair.

" 'No cumaghi inc7 famaidh buaidh .i. ferofergaib er 7 ferofergaib alban dodul cairir fair gan lumggan eachair .i. oubhoiaidh mac oarnain 7 fer dogaidelaib.—Locc aimfer iarcennfaela fin maghiarcormac imm. loc do aicill araice eemair 7 aimfero aimfer carbre Ihirecair mc. cormaic 7 fesra do cormac budein 7 cucaic adeirma .i. caech. fula cormaic dodaengur gaebuaibnech iar fuaraich ingine folair mc airc cuirb arairh ea. do cell. mc. cormaic, &c. I re cuic cormaic donliub. fa am araser er. 7 na blai. I re cuic cenofaela na fil ocha fairir. Nacomaidae cormac donghhe 7 comaide ceanofael dob. ar glunfraichi filifa fai 7 deirmerr. air. Cethar. meicgio rath coli. cormaicuacuino for rigne in leth .i. iarmocha cennfael mc aill.a. da fesra airead era cenofael mc aill.a. Iar nare oleas irin cach—he do rigne duil forcaidach.' "

" This title has been transcribed with the greatest care, separating the words, which are joined in the text. What follows is a literal translation: but it is fair to confess that in no other translation has the Compiler of this Catalogue found the difficulty which the abbreviations and some of the terms themselves, being Law terms of the most obscure antiquity, have in this instance imposed upon him.*

Literal Version.

" 'In the Name of God, this —— The place of this book (i. e. where it was written) was *Daire-lubran* (i. e. the Oak Grove of Lubran), and its time was when Donnald, the son of Aod,

* " In the Collectanea Hibernica, a very short fragment of these *Blai* is quoted, vol. ii. p. 8, &c. where the reading is very corrupt and different from this, and we are informed, after a few broken quotations, at page 20, that 'all the rest of the *Blai* are wanting, and all that part composed by Cinfaela and promulgated by Donald.'

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son of Ainmire, was King of Ireland;* and the person (i. e. the writer) was Cennfaelad, the son of Alill; and the occasion of composing it was because Dermod's ignorance yielded to Cennfaelad's skill, at the battle of *Moraith*,—(fought in 634. Annal. IV. Mag.)

"'Three victories were gained there. Congal, the Crooked, was defeated in his falsehood by Donnald in his truth;† and Subne the Mad ran mad on that occasion; and the unskilfulness of Dermod yielded to the skill of Cenfaelad.‡ The cause of the victory of Donnald over Congal, in truth, was this, that falsehood must always be conquered by truth.—The cause of the victory gained by Subne the Mad's turning mad, was, that he lost some Poems and Narratives, of which others availed themselves after.—The cause of the victory of Dermod's unskilfulness yielding to Cennfaelad's skill, was, that he (Cenfaelad) was educated at *Tuam-Drecan*, at the meeting of the three roads, between the houses of three learned men—that is, a Man skilled in Genealogies, and a Man skilled in Poetry, and a Man skilled in difficult reading; and whatever these three schools taught in the day, he, by the acuteness of his intellect, pondered over each night, and whatever was most difficult, he unknotted, and wrote down in his book of hard questions. We must not omit a fourth victory gained at that time—that is, that a man of Ireland, and another man of Albany, passed over to the East, without a ship of burthen, without a ship of war—namely, *Dubdiad*, the son of Daman, and another of the Gael.

"'The *place* and *time* of Cenfaelad's work is stated.—If you ask for Cormac's, the place where he wrote was *Acill*, near *Temora*: the time was when *Carbre Liffecar*, his son, was King of Ireland. The person who wrote it, was Cormac himself; the occasion of his writing it was, that being deprived of an eye by Angus of the Fearful Spear, after the daughter of Solar, the son of Art the Bastard, was violated in Rath-Aodh, by Ceallac the son of Cormac, and (being consequently disqualified to reign,) he retired to Acill, &c.

"'Cormac's part of this book is the Science of the laws of Ireland, and the *Blai*.—Cenfaelad's part is the Laws which follow them. The precepts of Cormac to the aged, the Precepts of Cenfaelad, to explain Law terms, difficult meanings, and devices.

"'The half the laws against falsehood—Cormac O'Con composed that half.
'The next after that Cenfaelad, the son of Alill, (composed.)
'A man of skill was he Cenfaelad, the son of Alil.
'He defeated the Ultonians in battle, and he composed the war songs.'§

"The sections of this fragment are 62. Each section begins with an ornamented initial, of a larger size than the other capitals, which mark the minuter divisions. The four first leaves con-

* "That is from 628 to 642.—This King *Donnald* is mentioned by Adamnan, in his Life of Columba, l. 1, c. 39, in Triade, p. 349.—'De bello in munitione *Cethirni*, in quo, ut multi norunt populi, Domnallus Aidi filius Victor sublimatus est.' The same battle is mentioned in the Irish Annals of the *IV Masters*, an. 624.

† "This seems to have been a Religious war between the Christian king Donnald and the Pagan Congal.

‡ "This was written before the art of dating by the Christian æra was known in Ireland, and therefore the author collects a number of cotemporary facts of universal notoriety, which served to establish his date. The Druids were not entirely suppressed in the 7th century.

§ "These four lines are written in the original as if they were prose.—What enables the translator to ascertain that they are in verse, is a regular cadence throughout, dividing the sentences into equal number of syllables. Vide next page.

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tain 19 sections; the first and second of which give the *title*, as above, with some additional circumstances, relating to the life of King Cormac.—Cenfaelad states in the third, that the Laws of the Irish are derived from four sources—the *Hebrew*, the *Greek*, the *Latin*, and the *Irish*; adding that there are several ancient *Irish* terms of Law, which are here explained in detail, and also eight *ernails* (or interpretations) of *Elgens* (or crimes) which are also explained in the sequel. The following inference is drawn near the end of this section:—'Ir ar sin ir follur o biar sir in cinaid ac suine gon coroibh sir nahepce conach amsir lan siach.—i. e. and hence it is plain that when once man comes to know a crime, though he knows not the punishment attached to it, he is liable to be punished accordingly.'

"The fourth section begins with the words 'Cirir folla eigsioch or f. im cia lecr no cia lin do ernailib epia fair o bheirigeh in cech. ir com. f. Isan tsenchaighe 7 i plaintigh.' These words are interlined with a very ancient gloss by *Cenfaelad*, from which it appears that this section treats of the various aggravating circumstances of crimes, and how each crime may be distinguished by its *ernail*, or signs and tokens. It also treats of *proofs of crimes*, and the necessity of corporal presence to establish evidence,—adding that the ignorant, and the Coward, who resemble brutes, must not be permitted to give evidence, even though their personal presence be ascertained: and here is quoted the authority of an ancient Poet, called *Fer-Muman mac Echgain*, whose words, in the ancient Irish idiom, are—

"'Conoh be ar. fot faiec. 7 imfhoecamruic.
Brithcach cathaiechar isoin—ir bhef. cumeisgaiscig.'

"These verses are written without any distinction of lines, or even of words, except rarely; and they are so written, that the second line must be read before the first. Several instances of this occur in Irish MSS. of great antiquity. Usher observes on an ancient MS. in which he discovered one of Columbanus's Poems, that it is all written as if it were prose. See his Sylloge, p. 99 and 122. Many similar instances occur in the writings of the middle ages, as noticed in the *Rerum Hibernicarum*, vol. 1. The above Irish verses may be interpreted thus:

"1. Whoever is in terror is a *Fot*.—He is false though he should strut as a champion.

"2. Wherefore it is said that *Fot* means a coward, and a confirmed *Fot* is a confirmed coward.

"The idiom alone sufficiently proves that these verses must be referred to a very remote period, even were it not for the circumstance of some of the words not being divided from each other, and being wholly unknown at this day: and though there are undoubtedly, in Cenfaelad's gloss, and in the parts of this work composed by him, some references to Laws enacted by the Christian Kings of Ireland in the 6th and 7th centuries, the parts ascribed to King *Cormac* are written in an idiom so very obscure and remote, as to justify, *ab intrinseco*, the positive assertion of *Cenfaelad*, that they are the genuine Laws of that Prince.

"The 5th section is *Cenfaelad's* interpretation of the Law terms of Cormac's work, beginning, 'Ciaimmano nacuma sin—What are the names of those crimes.'

"The 6th begins, 'Ro ranchaighair a cethair guch ne—Four qualities make known the extent of each crime.'

"The 7th is 'Teora roshlaroghta,—Three are the distinctive qualities of plunder.'

"The 8th is, 'Ria bead fiacha ferg—Let the extent of prosecution be proportioned to the degree of anger.' This treats of murder and manslaughter; the different legal names annexed to each degree of guilt, in respect to both; and the *erics* to be paid for them.

"The 9th is intitled, 'Ameic ae fefer cend rig,' &c. It treats of seven degrees of *erics*, and seven degrees of punishment for crimes, &c.

"The 10th begins, 'Ameic ara fef er follus,' &c.—The 11th, 'Amic ara feis er feineacht,' &c.—The 12th, 'Ameic ar Cinfluag for aen fer,' &c.—The 13th, 'Agus cinaenfir for fluag,' &c.—The 14th begins, 'Ameic arniur f. tir neorad ⁊ deor .f.' &c.—The 15th, 'Ameic arncinrig forthuaith,' &c.—The 16th, 'Amic arafeis er ferrechta,' &c.—The 17th, 'Amic arafeicht aenfer imam,' &c. The 18th, 'Amic arafefir fiachu.'—The 19th, 'Amic arafeifer fer ifren,' &c.—The 20th, 'Amic ar blai dilfi,' &c.—The 21st, 'Blai moga mugfaine,' &c.—22d, 'Blai echaenach,' &c.—23d, 'Blai echaenach.'—24th, 'Blai ordindeoin,' &c.—25th, 'Blai concongal,' &c.—26th, 'Blai Druith dibrucud, i. e. Laws concerning the expulsion of Druids.'—27th, 'Blai Mer cuirmtech.'—28th, 'Blai mein midclais.'—29th, 'Blai con cong,' &c.—30th, 'Blai echuirimurchur aporc a porc,' &c.—31st, 'Blai Liaghlinad,' &c.—32d, 'Blai fer catha,' &c.—33d, 'Blai Sustuaith.'—34th, 'Blai crann cutaim,' &c.—35th, 'Blai nuthlechnus achtrop doliaf,' &c.—36th, 'Blai Sufen Sairfe,' &c.—37th, 'Blai tarb ⁊ rethe darmna,' &c.—38th, 'Blai faebur comleng.'—39th, 'Blai dunadal.'—40th, 'Blai mucc orcel,' &c.—41st, 'Blai Liathroit lorg poll ⁊ locc,' &c.—'42d, 'Blai noi imrom.'—43d, 'Blai Liathroite urfcur faithce,' &c.—44th, 'Blai ceterig tulcompuc,' &c.—45th, 'Blai robcubad,' &c.—46th, 'Blai tene tellach,' &c.—47th, 'Blai Carpat Oenuch, &c.—48th, 'Blai Caire combruth,' &c.—49th, 'Blai-damh damhgal,' &c.—50th, 'Blai cuithech fliab,' &c.—51st, 'Blai Moga biail,' &c.—52d, 'Blai Cumul lecc.'—53d, 'Blai iafacht difoichid tairifid ogflan,' &c.—54th, 'Blai ar murgal,' &c.—55th, 'Blai muilenn bleith,' &c.—56th, 'Blai clefamnuig cleif.'—57th, 'Blai etha ithlaind,' &c.—58th, 'Blai iarunn airlech,' &c.—59th, 'Blai etar gaire imguin.'—60th, 'Blai bancatha ban,' &c.—61st, 'Blai cuaille airhe.'—62d, 'Blai deilge dae,' &c.—63d, 'Blai Tuath tregha.'

"That these Brehon Laws bear indisputable marks of original rudeness and simplicity, it is needless to say. Bede seems to advert to them where he says that the Irish permitted the *Picts* to intermarry with Irish women, provided the inheritance should pass to the descendants of these marriages in the female line,* which was contrary to the Laws of the Irish themselves, who never permitted inheritance except to the male line, and when that was extinct, to the senior male of the same name and next a-kin to the deceased. But whether Bede adverts in this passage to written or unwritten Laws, certain it is that the written Laws of Ireland are referred to by the *Ante-Danish* Poets of that Country, and by *Cenfaelad* in the 7th century; as well as by *Probus*, in the 10th; by *Tigernach*, in the 11th; and by the *Magnates Hiberniæ*, in the 14th.—Placed in the extremity of Europe, secluded from the rest of the world, unconquered, unmixed, and never affected by the concussions of the fall of the Roman Empire, the Irish must have possessed primeval institutions, which this MS. is the best calculated to unfold."

* "Bede, l. 1, c. 1."

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These remarks of Dr. O'Conor are well worthy the attention of the learned, and should excite an ardent desire for the publication of documents so important to the history of Western Europe. It should be stated, however, that in the translation of the preface to this work, Dr. O'Conor has fallen into several errors, but it is not considered necessary to enumerate them here, as, excepting in one instance, none of them affect the general sense of his version. This instance occurs in the last line of the quatrain, where "war-songs" is incorrectly given as the translation of *Duil Rosgadhach*, which is, in fact, simply the title of Cennfaela's Commentary on the Laws, as appears from Cormac's Glossary, in which it is frequently quoted.

3. That the Psalter of Tara was really, as stated, compiled in the time of Cormac, is an assertion the truth of which is much more difficult to prove than his claims to the authorship of laws. The very title given to this work is sufficient to excite well-founded suspicion of its antiquity; and no allusion to it has been found in the works of any author anterior to the eleventh century. It may also be remarked, that if such a work had ever existed, it would naturally be expected that, even though lost, it would have been quoted as authority, like the Psalter of Cashel, in the great compilations of Glendalough, Ballymote, Lecan, and Hy-Many; but no extract from it, at least nothing given as such, has been found in any of those or other works. It is true that the Four Masters refer to *Leabhar na h-Uidhri* and the *Dinnseanchus*, as containing transcripts from the Psalter of Tara; but on an examination of those MSS., nothing has been found that could, at least in their present mutilated form, be considered as the composition of so remote an age. The oldest authority yet discovered for the existence of the Psalter of Tara is to be found in the following verses in a poem by Cuan O'Lochain, which will be given entire in the course of this memoir.

Cormac ro clai caegad cath,	Cormac gained fifty battles,
Do rilaḋ ralteir Teaṁrach;	He compiled the Psalter of Temur;
Is in tsalteir sin a ta	In this Psalter is
An us deach suim seanchussa.	What is a good summary of history.
Is si in tsaltoir sin ad beir	It is this Psalter that gives
Seċt n-airdriġ Erenn indbir;	Seven monarchs of Erin of harbours;
Coic ri na coicceḋ sos gn:	Five kings of the provinces it makes,
Ri Erenn is a h-erri.	The King of Erin and her toparchs.
Is innti a ta de ceċ leith	In it are [entered] reciprocally

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Ino a nolig cech ri cuiccid,	What each king of a province is entitled to,
Ino a nolig ri Temrach toir	What the King of Temur in the east is entitled to
Do rig cec cuiccio ceolmoir.	From the king of each harmonious province.
Coimgniu comaimseraí caich,	The chronology and synchronism of all,
Cech rig oie roile doraith,	Of each king with each other, completely,
Criochad cech coiccio o cruaic,	The boundaries of each province from the hill,
O ta traigid co trom tuaiť.	From the *Traigid* to the heavy [large] *tuaith.*
Tricha ar trichaio ceo nor geib	Thirty above a *Triocha ched* [barony] it finds
Do trichuib ceo cec cuiccid.	Of *Triocha cheds* in each province.
In cech cuiceo oib a ta	In each province of them are
Secť prim ficit prim dingna.	Seven full score of chief fortresses.

A stronger objection, however, than any of the preceding, and which would apply to the other works ascribed to Cormac, as well as to the one in question, is the general belief of the learned that the Irish were wholly unacquainted with letters until the establishment of Christianity in the middle of the fifth century.

To the preceding objections it may, however, be answered, that it is not likely that a work called the Psalter of Tara could be thus referred to in a genuine poem of the eleventh century, written by one of the most distinguished men of his time, if such a work had not, at least, an existence in the popular traditions of the time; and it may be further argued, that it is difficult, if not impossible, to conceive how the minute and apparently accurate accounts found in various MSS. of the names and localities of the Atticotic tribes of Ireland in the first century, could have been preserved, without coming to the conclusion, that they had been committed to writing in some work, whatever may have been its original name, within a century or two of the times to which they relate.

It may be also urged, that, without conceding the use of letters to the Irish generally before the establishment of Christianity in Ireland, there is nothing improbable in the supposition that their use might have been known to a few, and, among those, to Cormac. Even the sceptical Innes says, "It may have very well happened that some of the Irish before that time, passing over to Britain or other parts of the Roman empire, where the use of letters was common, might have learned to read and write." The probability, moreover, that Cormac did not share in the imputed illiterateness of his countrymen, will be greatly increased by a consideration of the ancient tradition of his being an author, and still more from the sufficiently conclusive evidences derived from all the ancient authorities of his belief in the true God. But, without insisting on this argument, it may be

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urged with greater force, that there is considerable evidence to shew that Christianity itself had made no small progress in Ireland long before the middle of the fifth century, the period assigned to its general establishment. This fact is sufficiently manifest from the record of the mission of Palladius in the Chronicle of Prosper :—" Ad Scotos in Christum credentes ordinatus a Papa Celestino primus episcopus mittitur."

It even appears certain that there were bishops in Ireland before Patrick, though not commissioned from Rome, as, in a passage in Tirechan's Life of St. Patrick, written in the seventh century, it is stated that the Bishop Colman offered his church of *Cluain Cain* in *Achud* as a votive offering for ever to Patrick, who committed it to the care of the holy men, that is the priests, Medb and Sadb.

" Colmanus episcopus aeclesiam suam, id est, *cluain cain in Achud* Patricio episcopo de votiva immolatione in sempiternum obtulit et ipse eam commendavit sanctis viris, id est, prespitero Medb et prespitero Sadb."—*Book of Armagh*, fol. 17, p. a. col. 1.

And again, in a passage somewhat obscure, it is stated that a certain Irish bishop came to him from Caragh, in Connaught, to *Magh Tochuir*, in Donegal.

" Et exiit ad campum *Tochuir* et fecit aeclesiam ibi, et in quo loco quidam episcopus venit de genere Corcu Theimne ad eum de Cellola *Toch* in regiones *Temenrigi i Ceru* contra solis occassum ; episcopus cum sororo unâ monachi Patricii, et est locus eorum cum familia *Clono* et ingemescunt viri loci illius."—*Book of Armagh*, fol. 15, p. a. col. 2.

These passages receive corroboration from the words of St. Chrysostom, in his *Demonstratio quod Christus sit Deus*, written, according to Montfauçon, in the year 387, in which he states that the British islands situated outside the Mediterranean Sea, and in the very ocean itself, had felt the power of the divine word, churches having been founded there, and altars erected.

" Καὶ γὰρ αἱ βρετανικαὶ νῆσοι, αἱ τῆς θαλάττης ἐκτὸς κείμεναι ταύτης, καὶ ἐν αὐτῷ οὖσαι τῷ ὠκεανῷ, τῆς δυνάμεως τοῦ ῥήματος ἥψαντο. καὶ γὰρ κἀκεῖ ἐκκλησίαι, καὶ θυσιαστήρια πεπήγασιν."—*Opp. Edit. Bened. Tom. I.* p. 575, B.

And equally strong evidence, not only to this effect, but even to shew the use of letters at the same time, is derived from the historical notices of Celestius, the favourite Irish disciple of the heresiarch, Pelagius, as quoted by Archbishop Ussher from the work of Gennadius, *De Script. Eccl. Catal. :*

" Celestius antequàm Pelagianum dogma incurreret, imò adhuc adolescens, scripsit ad parentes suos de monasterio Epistolas in modum libellorum tres, omnibus Deum desiderantibus necessarias. Moralis siquidem in eis dictio : nihil ibi vitii postmodùm proditi, sed totum ad virtutis incitamentum tenuit."

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If, therefore, Celestius, while a youth, wrote letters from a foreign monastery to his parents at home, the conclusion is almost unavoidable, that his parents were able to read them. And as it appears from Marius Mercator that Celestius had been a disciple and hearer of Pelagius some twenty years before the disclosure of the Pelagian heresy in 405, the natural conclusion is, that letters were certainly known in Ireland, at least to some persons, in the beginning of the fourth century, and might possibly have been known nearly a century earlier, a period which would extend to Cormac's time.—See Ussher's *Primordia*, pp. 206 and 211, and *Rerum Hibernicarum Scriptores; Prolegomena*, p. lxxxiii.

Be this, however, as it may, it seems certain that Cormac must have had some knowledge of Roman civilization. It was this knowledge that enabled him to introduce the use of the water-mill into Ireland, as will be shewn in the course of this memoir; and, if such knowledge had not been acquired from Christian missionaries at home, it might have been an acquisition made during the three years which, according to the Annals of Tighearnach, he spent with his fleet abroad.

The preceding remarks may serve to excite inquiry into this interesting subject; but it is not, as already stated, the object of this paper either to affirm or deny the use of letters in Ireland before the formal introduction of Christianity; what has been said is intended solely to prove that the Four Masters, in their additions to the ancient annalist, had authorities which they believed sufficient for their assertions, and which should not be too hastily rejected as fabulous.

Before this subject is closed, however, it will be necessary to notice other amplifications of a more recent antiquary, which have tended in a larger degree than those already noticed, to create suspicions of the truth of the Irish histories of this time. The learned author of the Ogygia, not content with the statements of the Four Masters, adds, that there were three schools instituted by Cormac at Tara, in the first of which was taught military discipline, in the second history, and in the third jurisprudence. "Concerning these three schools," he continues, "and the magnificence of Temur in Cormac's time, and his encomiums and exploits, there is extant in O'Duvegan's book, fol. 175, a poem of 183 distichs, which begins—

"'Ceamair na riogh, raé Chormaic. "'Temur of the kings, fort of Cormac.'"

How far the poem here quoted by O'Flaherty, which is a composition of the

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fourteenth century, if not of an earlier age, may be received as authority for his statement with respect to these schools, the writer of the present memoir has no means of ascertaining, as the book of O'Duvegan, one of the most valuable repertories of ancient Irish literature existing, which formerly belonged to Sir William Betham, is now in the possession of a distinguished MS. collector in England; and no other copy of the poem is known to exist in Ireland. But the general silence of all the other ancient authorities on the foundation of these establishments, is in itself a presumptive evidence either that O'Flaherty had mistaken the sense of his author, as in the instance of *Mur Ollamhan*, or that the old poet himself had indulged in the common Bardic propensity to exaggeration.

The reign of Cormac is memorable, as the period in which the celebrated Finn Mac Cumhail, the Fingal of Mac Pherson's Ossian, flourished. His death is recorded by Tighearnach, at the year 272; but the true date, according to O'Flaherty, is 284. This distinguished man was the son-in-law of Cormac, and general of his army, which, as Pinkerton remarks, seems to have been an imitation of the Roman legions. "He seems," says the writer, "to have been a man of great talents for the age, and of celebrity in arms. His formation of a regular standing army, trained to war, in which all the Irish accounts agree, seems to have been a rude imitation of the Roman legions in Britain. The idea, though simple enough, shows prudence, for such a force alone could have coped with the Romans had they invaded Ireland. But this machine, which surprised a rude age, and seems the basis of all Finn's fame, like some other great schemes, only lived in its author, and expired soon after him."—*Inquiry into the Hist. of Scotland*, vol. ii. p. 77.

As the successors of Cormac Mac Art, at Tara, to the time of Dermot Mac Ceirbheoil, belong to a period of history now generally received as authentic, and are all in some degree connected with the monuments now or formerly existing there, it will be proper in this place to give a list of them in chronological succession, with an abstract of such important events of their reigns as bear particularly on the subject of this memoir. In this list the authority of Tighearnach will, as usual, be preferred to that of the later annalists; but, as there is a chasm in the former from the year 360 to the year 489, it will be necessary to use the other annals to supply the requisite links in the historical chain.

1. Eochaidh Gunnat succeeded Cormac, and reigned one year. The

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Four Masters, whose chronology at this period is very inaccurate, place the death of this monarch in the year 267 : according to the chronology of Tighearnach, the year would be 255 ; but the true year, according to O'Flaherty's corrected chronology, is 277. It should be observed, however, that the reign of this prince, though given in all the historical poems, &c., is not noticed in the Annals of Tighearnach, because, as Dr. O'Conor judiciously remarks, that annalist sometimes omits illegitimate kings.

2. Cairbre Lifeachair, son of Cormac Mac Art, and the one hundred and twenty-eighth monarch of O'Flaherty's list, succeeded, and, according to Tighearnach, after a reign of twenty-five years, was killed in the battle of Gabhra, near Tara, in the year 283. O'Flaherty, however, allows only sixteen years' reign to this prince, and dates the battle of Gabhra at 297.

3. Fiacha Sraibhtinne, son of Cairbre Lifeachair, reigned twenty-seven years, according to Tighearnach ; thirty-seven, according to the Four Masters ; and thirty, according to the Book of Lecan and O'Flaherty ; and was killed in the year 322, or, according to O'Flaherty, in 327.

4. Colla Uais, grandson of Cairbre Lifeachair by his son Eochaidh Doimhlen, reigned four years, and was driven from the throne into Scotland in the year 326, or, according to O'Flaherty, in 331.

5. Muireadhach Tireach, son of Fiacha Sraibhtinne, succeeded after having been king of Connaught ; and, after a reign of thirty years, according to Tighearnach, or twenty-six, according to O'Flaherty, was killed at the battle of Dabhall, in Oriel, in the year 366, or, according to O'Flaherty, in 357.

6. Coelbadh, of the line of the Dalaradian kings, after a reign of less than a year, was killed by his successor. This monarch, like Eochaidh Gunnat, is omitted, as an usurper, by Tighearnach.

7. Eochaidh Muighmheadhoin, son of Muireadhach Tireach, ascended the throne in the year 358, and, after a reign of eight years, died at Tara.

8. Crimthann, son of Fidhach, succeeded, according to the Four Masters, in 366, and, after a reign of thirteen years, was poisoned in 378.

9. Niall Naoigiallach, or Niall of the Nine Hostages, son of Eochaidh Muighmheadhoin, by Carinna, a Saxon lady, ascended the throne, according to the Four Masters and O'Flaherty, in 379 ; and, after a reign of twenty-seven years, was killed near the Ictian Sea, in 405. Although the events of the reign

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of this monarch are very imperfectly preserved by the Irish annalists, enough remains to indicate that he extended the power of the Irish monarchy farther than any of his predecessors within the limits of authentic Irish history.

10. Dathi, son of Fiachra, and nephew of the preceding monarch, succeeded, and, according to the Four Masters, after a reign of twenty-three years, was killed by lightning at the foot of the Alps, in 428, or, according to the *Chronicon Scotorum*, in 427. With this monarch the line of the pagan princes of Ireland closes; and though this line is as yet enveloped in deep obscurity beyond the reign of Tuathal, in the second century, there appears to be nothing in the time succeeding to excite doubt in a rational and unprejudiced mind. It is true, indeed, that the learned and judicious Sir James Ware has rejected, as of no certainty, the whole list of Irish kings anterior to the establishment of Christianity; but this overcautious rejection will have little weight now, even with the most judicious investigators, and in the opinion of Pinkerton, one of the most sceptical of modern antiquaries, "was at best rash." "Mr. O'Connor," says this writer, "remarks that Tuathal's reign forms a new and certain epoch in the progress of Irish history. Foreigners may imagine that it is granting too much to the Irish to allow them lists of kings more ancient than those of any other country in modern Europe: but the singularly compact and remote situation of that island, and its freedom from Roman conquest, and from the concussions of the fall of the Roman Empire, may infer this allowance not too much. But all contended for, is the list of kings, so easily preserved by the repetition of bards at high solemnities; and some grand events of history. For to expect a certain detail, and regular order, in the pagan history of Ireland, were extravagant. The Irish antiquists will, on the other hand, exclaim against this rejection of so many fables, which they call, and perhaps, if the human mind can be so debased, really think history. Mr. O'Conor says that the period from Tuathal to Leogaire is the most useful and important of the whole heathen history of Ireland. In which he is certainly right: and the traditions and bardish rhymes, with the early attention of the Irish, after conversion, to such learning as was then in vogue, promise considerable veracity to this last pagan period."—*Inquiry into the Hist. of Scotland*, vol. ii. p. 51.

In the list of Christian monarchs who ruled at Tara, now to be subjoined, Laoghaire, the son of Niall, will be placed at the head, for the sake of con-

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formity with the usual arrangement of Irish historians, founded on the Bardic poems and the majority of the published lives of St. Patrick, which allege the conversion of Laoghaire to Christianity before his death. As Dr. Lanigan, however, well observes, "this cannot be reconciled with what we read in other lives concerning his obstinate infidelity, nor by the saint in his confession:" and the correctness of this conclusion will be presently confirmed by an authority unknown to that most critical investigator, extracted from the annotations of Tirechan in the Book of Armagh.

I. *Laoghaire*, the son of Niall of the Nine Hostages, succeeded, according to the Four Masters, in the year 429; and, after a reign of thirty years, died in 458. The Annals of Ulster, however, place his death in 462, (which, as Ussher correctly observes, corresponds with 463 of our common era,) and O'Flaherty says that the thirty years allowed to his reign must be understood as subsequent to the conversion of his family to Christianity,—"ut in codice Lecano (fol. 306, *a*) ita Latinè explicatur: *Triginta annis regnum Hiberniæ post adventum Patricii tenuit.*"—*Ogygia.* p. 249.

With this account the computation of Tirechan, in the Book of Armagh, very nearly concurs, as follows: "A passione autem Christi colleguntur anni ccccxxxvi usque ad mortem Patricii. Duobus autem vel .v. annis regnavit Loiguire post mortem Patricii. Omnis autem regni illius tempus xxxvi ut putamus."—fol. 9, p. a, col. 2.

The Annals of Ulster, Innisfallen, and the Four Masters, as well as all the other ancient authorities, attribute the death of this monarch to the violation of his oath on the divine elements, which he had sworn to the Lagenians, that he would never again demand of them the Borumean tribute. This oath was taken in the year before his death, as stated in the Annals of the Four Masters:

Aoiſ Chriſt ceiṫre ċeo caoga a ſeacht. A naoi ſichet oo Laoġaire. Cath Atha oara ria Laiġniḃ ſor Laogaire mac Neill. Ro gaḃaḋ oon Laoġaire iſin cath ſin, aguſ oo rao Laoġaire ratha Ġreine aguſ Ġaoiṫe aguſ na n-oul oo laiġniḃ nach tiocſaḋ ſorraḋ tria bithin ar a léġaiḋ uaḋa.

"A. D. 457. In the twenty-ninth of Laoghaire. The battle ot *Ath dara* by the Lagenians, against Laoghaire, the son of Niall. Laoghaire was captured in that battle, and Laoghaire gave the guarantees of the sun, and of the wind, and of the elements to the Lagenians that he would never come against them on their letting him from them.

Aoiſ Chriſt ceithre ceo caocca a

"A. D. 458. Laogaire, the son of Niall of the

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hocht. Iar m-beit deic m-bliadna ficet hi rige n-Erenn do Laoġaire mac Neill Naoiġiallaiġ at bath i dtaob Caissi edir Erinn agus Albain .i. da cnoc iad sein filet i n-Uib Faolain, agus Ġrian agus Ġaot for marb foṁ, ár ro fáraiġ iad conid do sin at bert an fili—

At bath Laoġaire mac Neill,
For taob Caissi, glas a tir,
Duile de ad raegaid rait,
Tuc sat dail in báis fors an riġ.

Nine Hostages, after having been thirty years in the government of Ireland, died at the side of *Caisse*, between *Ere* and *Alba*, two hills, which are in *Hy-Faolain*. And the sun and the wind killed him because he had violated [his oath by] them. Of that event the poet said:

Laoghaire, the son of Niall, died
On the side of Caissi, green its land.
The elements of God, whose guarantee he had violated,
Executed the doom of death upon the king.

The preaching of Christianity in Ireland by Palladius and Patrick, and its alleged establishment by the latter during the reign of this prince, invest that reign with a degree of historical interest which does not appertain to any other portion of Irish history, whether antecedent or subsequent. Yet, though it might naturally be expected, from the importance of the events and the acknowledged use of letters in Ireland at this period, that a clear and authentic record of the preaching of the Gospel would be preserved, it must be confessed that the fact is far otherwise. The acts of Patrick, or perhaps the Patricks, for there appear strong grounds for presuming the existence of more than one preacher of the name, are involved in obscurities and contradictions which even the learning and judgment of Ussher and Lanigan, as well as of many others, have failed to penetrate and explain. Still, however, the labour should not be abandoned as hopeless. Many ancient documents, unknown to, or beyond the reach of former investigators, still exist; and the examination of these holds out a hope to those who may devote their time and learning to the subject, that their exertions may be crowned with success. Such an examination, however, would be as much beyond the limits as it would be foreign to the object of this memoir; but as the preaching of Patrick at Tara is one of those facts on which all authorities concur, and as this event is, moreover, connected with some of the remains to be illustrated as still existing on the spot, it will be necessary to give some account of it in this place; and, for the sake of brevity, this will be given in the condensed abstract furnished by Dr. Lanigan.

After narrating the progress of St. Patrick, during the latter end of the year 432 and part of 433, until the approach of Easter, when he determined on

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celebrating that festival near Tara, the Doctor proceeds thus :—" On the following day, which was Easter-eve, or Holy Saturday, St. Patrick continued his journey, and arrived in the evening at a place called *Ferta-fer-feic*, now Slane. Having got a tent pitched there, he made preparations for celebrating the festival of Easter, and accordingly lighted the paschal fire about night-fall. It happened that at this very time the king, Leogaire, and the assembled princes, were celebrating a religious festival, of which fire-worship formed a part. There was a standing law, that, at the time of this festival, no fire should be kindled for a considerable distance all around, until after a great fire should be lighted in the royal palace of Temoria or Tarah. St. Patrick's paschal fire was, however, lighted before that of the palace, and, being seen from the heights of Tarah, excited great astonishment. On the king's inquiring what could be the cause of it, and who could have thus dared to infringe the law, the Magi told him that it was necessary to have that fire extinguished immediately, whereas, if allowed to remain, it would get the better of their fires, and bring about the downfall of his kingdom. Leogaire, enraged and troubled on getting this information, set out for Slane, with a considerable number of followers, and one or two of the principal Magi, for the purpose of exterminating those violators of the law. When arrived within some distance from where the tent was, they sat down, and St. Patrick was sent for, with an order to appear before the king and give an account of his conduct. It was arranged that no one should show him any mark of respect, nor rise up to receive him. But, on his presenting himself before them, Herc, son of Dego, disobeyed the injunction, and standing up, saluted him, and receiving the Saint's blessing, became a believer. He was afterwards Bishop of Slane, and celebrated for his sanctity. Passing over certain contests between St. Patrick and the Magi, and some partly prodigious and partly ridiculous fables, we find St. Patrick the next day (Easter Sunday) in the palace of Tarah, preaching before the king and the states general, and disconcerting the Magi. The only person, that on his appearing there, rose up to pay his respects to him was Dubtach, an eminent poet and instructor of Fiech, son of Erc, who afterwards became Bishop of Sletty. Dubtach was the first convert on that day, and the saint became greatly attached to him. Thenceforth he dedicated his poetical talents to Christian subjects, and some works of his are still extant."—*Eccles. Hist.* vol. i. pp. 223-5.

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For the facts stated in the foregoing abstract it is not necessary here to quote the original authorities, particularly as a sufficient agreement is found, not only in all the lives of Patrick published up to Lanigan's time, but also in those which have been since published from the Book of Armagh; and though these lives exhibit all the usual admixture of miraculous fables so characteristic of the lives of Irish Saints, there is nothing in them which should impeach the truth of the leading incidents which they record. There is, however, connected with this important event an ancient document still preserved, though hitherto unpublished, of such singular interest, whether considered as the oldest undoubted monument of the Irish language remaining, or as an illustrative record of the religious doctrine inculcated by St. Patrick, that a more than usually copious account of it can hardly fail of being acceptable to the readers of this memoir. The document here alluded to is an ancient Irish hymn of St. Patrick, which he is stated to have composed and sung with his followers when approaching Tara, surrounded by his pagan enemies. The circumstances which occasioned the composition of this hymn are thus detailed in the Tripartite Life of St. Patrick, a compilation of the ninth or tenth century, but, as Colgan, who has published a Latin translation of it from the original Irish, supposes, first written by St. Evin in the sixth century, though subsequently interpolated.

"Cùm perversus Rex videret se non posse viâ jam excogitatâ sanctum virum è medio tollere, excogitavit et aliam. Invitat ipsum Temoriam, promittens quod ibi coram regni proceribus facturus sit publicam fidei professionem, et in Christum coram toto regno crediturus. Hæc fuit professio oris, sed longè alia meditatio cordis iniqui tyranni. Per loca enim, per quæ sanctus Pontifex transiturus erat, varias instruxit insidias ad ipsum, antequam Temoriam veniret, è medio tollendum. Sed licet servus Christi fidelis Domino revelante hæc non ignoraret, in Domino tamen jacens suum cogitatum, statuit Temoriam proficisci, et discrimen imminens divinæ relinquere dispositioni. Promittit ergò se Regem ponè secuturum: et sequitur cum octo clericis, et Benigno puero: quos sua sacra benedictione et oratione contra paratas insidias, et omnia pericula munivit. Et sic per medios insidiantium cuneos transibant: quorum et oculi tenebantur, ne eos agnoscerent. Obtutibus enim ipsorum solùm apparuerunt octo cervi cum uno hinnulo, in cujus dorso videbatur aliqua sarcina jacere. Sic ergò mirificus vir sociique cum beato puero Benigno sacrum Bibliorum codicem in humeris gestante, per medios hostes salvi et incolumes Temoriam usque pervenerunt, salvifico orationis viri Dei præsidio, velut sacrâ ægide, muniti. Tunc vir sanctus composuit illum Hymnum patrio idiomate conscriptum, qui vulgò *Feth-fiadha*, et ab aliis *lorica Patricii* appellatur; et in summo abinde inter Hibernos habetur pretio: quia creditur, et multa experientia probatur, piè recitantes ab imminentibus animæ, et corporis præservare periculis."—*Septima Vita Tripartita S. Patricii*, pars I. cap. lx. Tr. Th. p. 126.

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That the hymn or psalm thus distinctly named as the composition of Patrick is the identical one which will now be presented to the reader, will appear sufficiently obvious from the ancient preface prefixed to it, in which its origin is accounted for in nearly the same words. The MS. from which it has been taken is the celebrated *Liber Hymnorum*, preserved in the Library of Trinity College, Dublin, a manuscript which, in the opinion of Archbishop Ussher, as expressed in a letter to Vossius, was in his time a thousand years old.—See *Epist. ad Vossium, in Dissert. de Symbolis Antiq.* For the satisfaction of the learned, an interlineary Latin translation is given, as it would be impossible to retain the sense in the original order of words in an English one; and, as the orthography of the words generally varies from that of more modern productions, and as many of the words themselves have been long obsolete, authorities for their explanations will be appended in notes. The characters used in the text will give a good general idea of those in the MS., and the ornamented capital is a *fac-simile* of the original one. It is only necessary to add here, that this hymn is in that ancient dialect of the Irish called *Bearla Feine*, in which the Brehon Laws and the oldest tracts in the language are written.

Hymn of St. Patrick.

Patraicc do rone inn immun so. In aimseir Loegaire meic Neil do rigneo. Fat a denma h. dia diden co na manchaib ar náimdib in bais ro batar in etarnid ar na cleircheib. Ocus is luirech hirse inso fri himdegail cuirp ocus anma ar demnaib ocus duínib ocus dualchib. Cech duine nos geba cech dia co n-innithem leir i n-dia ni thairisset demna fri a gnuis. Dio dicin do ar cech neim ocus format. Dio comna do fri dianbas. Dio lurech dia anmain iar n-a étsecht. Patraicc ro chan so in tan do rata na hetarnaidi ar a chinn o Loegaire, na digsed do silad chreiome co Temraig; conio annsin at chessa fiadlucht na n-etarnade comtis aige alta, ocus iarnde i n-a n-diaid .i. benen. Ocus feth Fiada a hainm.

"Patrick composed this hymn. In the time of Loegaire, the son of Nial, it was composed. The cause of its composition was to protect himself with his monks against the enemies unto death, who were in ambush against the clergy. And this is a religious armour to protect the body and soul against demons, and men, and vices. Every person who sings it every day with all his attention on God, shall not have demons appearing to his face. It will be a protection to him against every poison and envy. It will be a safeguard to him against sudden death. It will be an armour to his soul after his death. Patrick sang this at the time that the snares were set for him by Loegaire, that he might not come to propagate the faith to Temur; so that it appeared to those lying in ambush, that they were wild deer, and a fawn after them, that is Benen. And *Feth fiadha* is its name."

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[1] Do-
Ad
[2] Temoriuġ [3] indiu [4] niurt [5] tren [6] to-
Temoriam hodie potentiam præpollentem in-
[7] ġairm [8] Trinoit.
voco Trinitatis.
[9] Cretim [10] Treodatad [11] foisin [12]
Credo in Trinitatem sub
oendatad [13] in [14] Dulemain [15] Dail. [16]
Unitate eos numinis elementorum.

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[1] A, in, or at: *vic hodie.*

[2] Domriuġ: apparently an obsolete form of Deamruġ, dat. of Deamur.

[3] Indiu, to-day: now generally written inu or anu in Irish, but *andiu* in the Erse.

[4] Niurt, strength, force, power: so written in many ancient MSS., but now always neapt.

[5] Tren, strong, mighty: so written in all the ancient MSS., but in the modern ones tpéan.

[6] Togairm: used as a noun in the modern MSS. and in the Annals of the Four Masters, at the year 1577, in which sense it is taken by O'Clery, who, in his dictionary of obsolete Irish words, explains it by aéaé no guioe óian, i. e. a supplication or earnest entreaty: but here it is certainly employed as a verb, and means, I invoke, beseech, implore.

[7] Trinoit, the Trinity: now always written Tpionoio. In the ancient MSS. t is frequently used for the o of the moderns. The same change is observable in the Welsh, Spanish, and Italian.

[8] Cretim, I believe: now cpeioim.

[9] Treodatad. This word is now obsolete, but its meaning is evidently triplicity, or tripartite division. The termination atarc is no longer in use.

[10] Foisin, under the, is compounded of the preposition fo1 under, and the article an or in, the, the p being inserted to avoid a hiatus, as in cpep, leip, ip, annp.

[11] Oendatad, unity: now written aonoacc. In the ancient MSS. ae and oe are almost invariably used for the ao of the moderns.

[12] In, the: now written an, but in the ancient MSS. almost invariably in.

[13] Dulemain, gen. form of duilem, the Godhead, the Creator of the Elements: a word evidently of pagan origin; it is derived from dul, element. At this day the phrase piġ na n-dúl is universal in Ireland, and is understood to mean God, i. e. the King of the Elements.

[14] Dail: now duil, of the elements.—See quotation in O'Reilly's Dictionary *in voce* dul. In an old Litany preserved in the *Leabhar Breac*, fol. 121, *b*, the Creator is thus addressed: "A Dhe uli chomaccuiġ, a óe na nióġ, a óe uaṫail, a éiġeṁa an domain, a Dhuilimh na ndul,—Epchp oinn." And again, in the same Litany: "Deipcher ap n-aiéneacé epéimeṫa i praonuipe in Dúileman, ár nic piú finn fém ár n-éiteche," let our devotedness be carried through thee in

a tomriuȝ indiu niurt ȝene[15] crist[16] co n-a[17]
Apud Temoriam hodie virtutem nativitatis Christi cum eâ ejus

baṫhius,[18] niurt crochta[19] co n-a adnocuil,[20] niurt
baptismi, virtutem crucifixionis cum eâ ejus sepulturæ, virtutem

n-eseirȝe[21] co presȝabail,[22] niurt toniud[23] do[24] bre-
resurrectionis cum eâ ascensionis, virtutem adventûs ad ju-

themnas[25] bratha.[26]
dicium æternum.

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the presence of the Godhead, (*Duileman,*) for we ourselves are not worthy of being heard. In Colembkille's Latin Hymn in praise of the Trinity, this phrase dúilem n-a nóúl is expressed thus: "Deus princeps principum, elementorum omnium."—*Trias Thaum.* p. 476.

[15] ȝene, of the birth, gen. of ȝen, the birth; Greek γενεσις.

[16] crist, *sic hodie.* The nom. form is written Criosr in modern books.

[17] conȝ, with his, compounded of co, Lat. *cum*, with, and a, his, the n being inserted to avoid a hiatus: now written ȝo n-a; but conȝ is found in this sense in modern MSS. as well as ancient.

[18] baṫhius, baptism: now always written baiṫse. Both are apparently derived from the Greek, βαπτισμα, through the Latin, though they bear a strong analogy with the primitive Irish word baṫáṫ, to drown, and baṫ, the sea. The form of the word here used is found in very old MSS. as in the preface to a fragment of the *Seanchus Mor*, preserved in a MS. in Trin. Col. H. 3, 17, p. 1. "Ratsis do ṫaṫaṫaṫ i n-Eirinn do ṫiaṫ baiṫeṁ ocus creisine."

[19] crochta, of the crucifixion, gen. of croċaṫ, which is derived from croċ; Lat. *crux*, the cross. This word is still used by the Irish.

[20] adnocul, burial: now written aṫlaċaṫ, but adnocul is used in all the ancient MSS., and explained in the Glossaries of Cormac and O'Clery as signifying burial—"Adnocal .i. cuṗ marb .i. aṫlaċaṫ."—*O'Clery.* This is a primitive Irish word, not borrowed from the Latin.

[21] eseirȝe, resurrection: *sic hodie*, and derived from ess, again, and eirȝe, to rise.

[22] fresȝabail, ascension: now easaȝabáil. In every part of Ireland where the Irish language is understood, Ascension Thursday is called Diardaoin Deaṫaȝabáil. The word is thus explained by O'Clery in his dictionary of obsolete Irish words: "Fresagabail .i. dul an neam do Chriosd, *ascensio.*" This also is a primitive Irish word.

[23] toniud, coming. This word is now entirely obsolete, but O'Clery explains it by teaċt, coming: "Tomeoimiuḋ .i. imeaċt; tomeoimiuḋ la aṫair oiḋċe .i. imeaċt laiṫe aṫair oiḋċe; oir is ionann toimiuḋ aṫus teaċt." This is the root from which the present tainig is formed.

[24] do, to: now always ȝo, but do is used after a verb of motion in many old MSS.

[25] bretheminas, judgment: now in common use, but spelled, according to the modern orthography, breiṫeaṁnas. This is a primitive Irish word, formed from breiṫeaṁ, a judge.

[26] bratha, of eternity: *sic hodie.* Go brath is still used to mean for ever, and la an Brathra and la an Breiṫeaṁnais, the Day of Judgment. This also is a primitive Irish and British word.

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A TOMRIUG INDIU NIURT GRAD[27] hIRUPhIN[28] IN[29] URLA-
Apud Temoriam hodie virtutem amoris Seraphin in obse-

TAID[30] AINGEL,[31] hI[32] FRESCISIN[33] ESEIRGE AR CENN[34] FOCh-
quio angelorum, in spe resurrectionis ad adipiscendum præ-

RAICE.[35] IN ERNAIGThIb[36] hUASAL[37] AThRACh[38] I TAIRChET-
mium. In orationibus nobilium patrum in prædicti-

LAIb[39] FAThA.[40] hI PRAICEPTAIb[41] APSTAL,[42] IN hIRESAIb[43]
onibus prophetarum, in prædicationibus apostolorum, in fide

---

[27] GRAD, of the love: *sic hodie*, but the D is always aspirated.

[28] hIRUPhIN: evidently intended for *Seraphin*.

[29] IN, in, on: *sic hodie*.

[30] URLATAID, humility. This word is explained in O'Clery's Glossary, by the modern word uṁalow, obedience, obeisance. The latter bears a close affinity to the Latin, the former none whatever.

[31] AINGEL, of angels: *sic hodie*, but spelled n-aingeal.

[32] hI, in: the aspirate h is frequently prefixed to the preposition i, in.

[33] FRESCISIN, expectation. It is now obsolete; but it is of frequent occurrence in this sense in the *Leabhar Breac*.—See fol. 18, *b*, 1, and 127, *b*, 1.

[34] AR CENN, literally, on head, is used as a compound preposition in the best Irish MSS. to signify for, towards, for the purpose of, to the end that.

[35] FOChRAICE, reward: this is the gen. form of fochraic, which O'Clery explains by luaideacht, reward, recompense; and in the Annals of the Four Masters, at the year 1541, it is used in the sense of eternal reward. This word is of frequent occurrence in the *Leabhar Breac*: "máſa erbálta iaram immad na fochraice nemdai."—*Fol.* 127, *b*, 1.

[36] ERNAIGThIbh, prayers, dat. pl. of ernaiġe, prayer. The modern word is urnaiġe.

[37] hUASAL, noble: now uaſal. In the old Irish MSS. h is frequently prefixed to words beginning with vowels, sometimes to avoid a hiatus, and sometimes for no apparent reason.

[38] AThRACh, of fathers: *sic hodie*.

[39] TAIRChETLAIb, prophecies, dat. form of taiṙcetal, prophecy. In the more modern MSS. it is written taiṙceadal, which is the spelling adopted in O'Clery's Glossary, in which it is xplained by ſáiſtine, the modern word for prophecy, borrowed from the Latin *vaticinium*.

[40] FAThA, prophets: *sic hodie*, Lat. *vates*.

[41] PRAICEPTAIb, dat. plural of praicept, preaching. This word is written preceṗt in Cormac's Glossary, under the word cruimṫeṙ, a priest, and proiceṗt in the Annals of the Four Masters, at the year 1441. In a passage in the same Annals, under the year 1020, caṫaoiṙ na proiceptu, literally, the chair of preaching, is used to express a pulpit.

[42] APSTAL, of the Apostles: *sic hodie*. This was certainly borrowed from the Latin.

[43] hIRESAIb, dat. plural of iṙiſ, faith, religion. "Do ſilaò creiome ocuſ iṙſe."—*Life of St. Patrick* in the *Leabhar Breac*. "Na h-iṙſe Catholici," of the Catholic faith.—*Ibid.*

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ꝑuismeꝺach,[44] ın enꝺꝺa[45] noem[46] ınġen,[47] hi nġnimaiḃ[48]
confessorum in castitate sanctarum virginum, in actis

ꝑer ꝑirean.[49]
virorum justorum.

a ꝺomrıuꝺ ınꝺıu nıurꝺ nime,[50] soıḃse[51] ġrene,[52]
Apud Temoriam hodie potentiam coeli, lucem solis,

ecrochꝺa[53] snechꝺai,[54] ane[55] ꝺhened,[56] ꝺene[57] ɫochet,[58]
candorem nivis, vim ignis, rapiditatem fulguris,

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[44] ꝑuismeꝺach, confessors, from ꝑoırꝺı, confession: now obsolete. An example of the meaning of this word occurs in a MS. in the Library of Trinity College, Dublin, Class H. 1, 11, p. 114: "Do ꝺoṫó aṁuıngiṅ na mąıṡṙach ąṫąr na ḃ-ꝑaırmeaꝺach."

[45] enꝺꝺa, purity: now obsolete, but explained ġlanne.—See O'Reilly's Dictionary *in voce* eanġaꝺa, which he explains from an old Glossary by the modern word ġlan.

[46] noem, holy: now written naoṁ. See Note [44].

[47] ınġen, daughter, girl, virgin: *sic hodie*, but written ınġean.

[48] ġnimaiḃ, deeds, works, dat. pl. of ġnıṁ: *sic hodie*, but written ġnıoṁ.

[49] ꝑer ꝑirean, of just men: *sic hodie*, but written ḃ-ꝑeaꝑ ḃ-ꝑíṙéam.

[50] nime, of heaven, gen. of neaṁ, heaven: *sic hodie*. Lat. *nimbus*.

[51] soıḃse, light: *sic hodie*.

[52] ġrene, of the sun, gen. of ġnıan, the sun: *sic hodie*. It is remarkable that no cognate is found for this word in any of the other Indo-European languages. The Hebrew חרם is not far from ġnıoć and ċnıoṙ, other Irish forms of this word, and the Algonkin *Grounia*, and the Kabyle *Gronhia* are still closer to ġnıan.—See *Ordnance Memoir of Templemore*, p. 212.

[53] ecrochꝺa, brightness, whiteness: written ecroṁchea in less ancient MSS. It is formed from oṙóċe, dark, thus: oṙóċe adject. dark, oṙóċea, subst. darkness, negat. eoṙóċe, bright, eoṙóċea, brightness. In like manner eoṫṙom, light, is formed from ṫṙom, heavy.—See O'Clery *in voce* oṙóċe. Various examples of its meaning are found in the *Leabhar Breac*. Thus: "Co n-ecroċea ġnene," with the brightness of the sun, &c. fol. 126, *b*, 2. "Coṁṫaṁne ocuṙ coṁṫoıllı ꝛu héċroċea peoleno," with a purity and brilliance equal to the brightness of a star.—*Ibid.* fol. 127, *b*, *v*.

[54] snechꝺai, of snow: *sic hodie*, but written ꝛneaċta. Neċta, which is cognate with the Latin *nix*, is another ancient form of this word.

[55] ane, force, quickness. "Aıne .ı. luaṙ no oéıne."—*O'Clery.*

[56] ꝺhened, of fire: *sic hodie*, but spelled ꝺeneaḋ; old Germ. *tinden*, to kindle.

[57] ꝺene, rapidity, a substantive formed from the adjective ꝺıan, rapid: *sic hodie*.

[58] ɫochet, of lightning. This word is explained in the margin of the MS. by the word ɫaṫṙaċ, flame or lightning. It is of frequent occurrence in the ancient Irish MSS. in which it is used to signify lightning or a thunderbolt. Thus in Cormac's Glossary, under the word ꝑnull: "ḃaṫ ṫuaiṫéṙeṙ ɫoċaıṫ ꝛoṙ ɫaṙṁan," more rapid than lightning (striking) against a pillar. It is written ɫoıċeaṫ by O'Clery, who explains it "ꝛuıġnean, ċaoṙlaṫaṁ, no ṙıaṫa ꝛoluꝛca."

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LUATHE[59] GAETHE,[60] FUDOMNA[61] MARA,[62] TAIRISEM[63] TAL-
velocitatem venti, profunditatem maris, stabilitatem ter-
MAIN,[64] COBSAIDECHT[65] AILECH.[66]
ræ duritiam petrarum.

A TOMRIUG INDIU NIURT DE DOM LUAMARACHT,[67]
Ad Temoriam hodie potentia Dei me dirigat,
CUMACHTA[68] DE DOM CHUMGABAIL,[69] CIALL[70] DE DOMM
potestas Dei me conservet, sapientia Dei me
IMTHUS,[71] ROSC[72] DE DOM REIMCISE,[73] CLUAS[74] DE DOM
edoceat, oculus Dei mihi prævideat, auris Dei me

---

[59] LUATHE, swiftness: *sic hodie*, but spelled luaithe.

[60] GAETHE, of the wind: *sic hodie*, but written gaoiṫe.

[61] FUDOMNA, depth, profundity: formed from doṁain, deep. O'Reilly explains fodoṁain a gulf; but he gives no example or authority to support that meaning.

[62] MARA, of the sea, gen. of muiṛ, the sea: *sic hodie*.

[63] TAIRISEM, stability. "Taiṛiṛioṁ .i. toiṛiṛioṁ .i. coṁnuiġe."—*O'Clery*.

[64] TALMAIN, of the earth, gen. of talaṁ, the earth: now talṁan; Lat. *Tellus*. It is remarkable that the gen. form of talaṁ, the earth, and duileṁ, the Lord of the Elements, differs in this hymn from that found in the best Irish MSS., in which it is formed by adding an.

[65] COBSAIDECHT, solidity, firmness. This word is used in medical MSS. to express firmness, but is not explained in any Irish dictionary.

[66] AILECH, of rocks. This word is thus inflected: nom. aileach, gen. ailiġe, dat. ailiġ. "Roṛ eṛcend bloḋ dond ailiġ fo ṛuil Neḋe:" a splinter of the rock flew at the eye of Nedhe.—*Cormac's Gloss. in voce* gaiṛé.

[67] LUAMARACHT, piloting. This word, formed from luamaiṛe, which is explained by O'Clery, loingṛeóiṛ, i. e. mariner, is of frequent occurrence in the Annals of the Four Masters in the sense of piloting, steering, &c. See also Cormac's Glossary *in voce* Nemġnaċt.

[68] CUMACHTA, power: *sic hodie*, though sometimes written coṁaċta. It is compounded of com, which has the same power as the Latin *con*, and macht, *might* or *power*; German, *macht*; Engl. *might*.

[69] CHUMGABAIL, keeping: now congbail, compounded of cum, and gabal, like the Latin *com-prehendo*.

[70] CIALL, sense, wisdom: *sic hodie*. Gen. céille; obliq. céill.

[71] IMTHUS, instructing. "Iomṫúṛ .i. ṛgéala."—*O'Clery*.

[72] ROSC, the eye. "Roṛg .i. tuicṛin no ṛuil."—*O'Clery*. This word is still understood.

[73] REIMCISE, foreseeing. This form is now obsolete, but it is obviously from ṛeiṁ, before, of the same force as the Latin *præ*, and ciḋim, I see. In the more modern MSS. ṛeiṁṛ́echain and ṛeimdechṛin are the forms most generally used.

[74] CLUAS, the ear: *sic hodie*; Greek, κλυω, to hear.

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ESTECHT,[75] BRIATHAR[76] DE DOM ERLABRAI,[77] LAM[78] DE
exaudiat, verbum Dei me disertum faciat, manus Dei
DOMM IMDEGAIL,[79] INTECH[80] DE DOM REMTHECHTAS,[81]
me protegat, via Dei mihi patefiat,
SCIATH[82] DE DOM DITIN,[83] SOCHRAITE[84] DE DOMM ANU-
scutum Dei me protegat, exercitus Dei me defen-
CUL,[85] AR[86] INTLEDAIB[87] DEMNA,[88] AR ASLAIGTHIB[89] DUAL-
dat, contra insidias dæmonum, contra illecebras viti-

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[75] ESTECHT, hearing: *sic hodie*, but spelled éirteacht.

[76] BRIATHAR, word: *sic hodie.*

[77] ERLABRAI, to render eloquent: now urlabhraidh. The prefix er is frequently used in ancient Irish MSS. for the modern ur or or, as erpoirc for orpheasrc, illustrious; erdam for urdam, an apartment in a house; erdalta for urdalta, certain; erpaigde for urnaighe, prayer.

[78] LAM, hand: *sic hodie*, but the m is always aspirated.

[79] IMDEGAIL, protecting or shielding; "imdeghail .i. anacal."—*O'Clery.* "Sgiath imdeaghla na naimhe."—*Shane O'Mulconry of Ardcholl.* "Imdeaghla .i. anacla."—*Teige O'Rody of Crossfield.* "Tabhair dam do noéim fripraic dom imdegail ocus dom imdidean:" give me thy holy spirit to protect and shelter me.—*L. Breac, fol.* 121, *b.*

[80] INTECH, way. "Indeadh .i. fligh."—*O'Clery.* "Indeadh .i. fligh."—*Peter Connell.*

[81] REMTHECHTAS. This form is not given in any Irish Dictionary, but remthéadhe and remthéadtaire, words similarly compounded, are of constant occurrence, the former signifying coming before, and the latter a forerunner.

[82] SCIATH, a shield: *sic hodie.*

[83] DITIN, sheltering, protecting: now oidhin.—See Note [79].

[84] SOCHRAITE, a host: *sic hodie.* This word is of constant occurrence in the Annals of the Four Masters, in the sense of host, army, multitude.

[85] ANUCUL, protection: of constant occurrence in the Annals of the Four Masters: "na eaglais ernuidhe do anacal lairr co n-a luidhe do ceilb de acus do lobradh."—*Four Masters, ad ann.* 919.—See this passage, translated in Colgan's *Trias Thaum.* p. 296.

[86] AR, on, against: *sic hodie*, but generally written air.

[87] INTLEDAIBH, snares, *insidiis*, dat. plur. of inneall, snare. This word is of frequent occurrence in the Irish Annals: "Ro himoldedh in ceadh."—*Four Masters.* The only form of this word now in use among the Irish is inneadh, a snare. In the ancient Irish MSS. no and ne are often used for the nn of the moderns. In a MS. in Trin. College, H. 3, 18, p. 524, the phrase inna hinneleabaibh is glossed by the more modern form ir na himoldibh, i. e. *in insidiis.*

[88] DEMNA, demons: now written deamhna. This word is evidently derived from the Latin *daemon.*

[89] ASLAIGTHIB, temptations, dat. plur. of aslaigh, temptation. See O'Reilly *in voce* aslach, and Annals of the Four Masters, in which the word occurs in the sense of solicitation, &c. This

ChET,[90] AR IRNECHTAIb[91] AICNID,[92] AR CECh[93] ṄDUINE[94]
orum, contra inclinationes animi, contra omnem hominem

MIDUS[95] ThRASTAR[96] DAM[97] I CEIN[98] OCUS[99] IN OCUS[100] I
qui meditetur injuriam mihi procul et prope

N-UATHED[101] OCUS hI SOCHAIDE.[102]
cum paucis et cum multis.

TOCUIRIUS[103] ETRUM[104] ThRA[105] NA[106] hUILE[107] NERT SO[108]
Posui circa me sane τας omnes potentias has

---

word occurs in the *Leabhar Breac*, fol. 121, *b*, in the sense of temptation, allurement, &c. "Dom ımdeġaıl ocuſ dom anacol aſ deṁnaıḃ, co na ulıb aımſıġṫıḃ ocuſ aſlaıġıḃ:" to defend and protect me against demons and all their attacks and temptations.

[90] DUALChET, vices: now written duḃaılceḋ.

[91] IRNECHTAIb, inclinations: now obsolete.

[92] AICNID, of the mind, *animi:* now aıġnıḋ.

[93] CECh, every, occurs in all the old MSS., but is now always written and pronounced ġach.

[94] DUINE, person: *sic hodie.*

[95] MIDUS, who meditates. This occurs frequently in the old MSS., but in modern books and dictionaries it is written mıoḋaſ. The word mıḋeaṁaın, which is a verbal noun formed from this, is explained by O'Clery thus: "mıḋeaṁaın .ı. ſmuaıneaḋ aſ a dtuġṫaſ *meditatio.*" "Co ro ſéġtaıſ ocuſ co ro mıġṫıſ ıſeſn."—*Leabhar Breac*, fol. 127, *b*, 2.

[96] ThRASTAR, injury, opposition, adverseness. It is formed from the adjective traſda or traſta, cross, perverse.

[97] DAM, to me: *sic hodie.* This is one of those instances of a union of a pronoun and preposition in one word, peculiar to the Irish and its cognate dialects.

[98] I CEIN, afar, at a distance: *sic hodie*, but generally written a ġcéın or ı ġ-céın.

[99] OCUS, and: now always written aġuſ; Lat. *atque*, which may have been originally written *acque.*

[100] IN OCUS, near: now ı n-ſoġuſ and ı ḃ-ſoccuſ.

[101] IN UATHED, alone, or with a few. This phrase is of constant occurrence in the Annals of the Four Masters, and is thus explained by O'Clery: "uaṫaḋ .ı. aon nı aṁáın .ı. an noıṁıſ aonda, ġuſ ab uıme ſın a deıſṫeaſ uaṫa ſe beaġán aſ bıṫ."

[102] SOCHAIDE, an army, host, or multitude. This, as well as ſochſaıte, *quod vide supra*, is of frequent occurrence in the Annals of the Four Masters.

[103] TOCUIRIUS, I have placed, indic. past, first pers. sing. of the verb toċuıſım, I place, an intensitive form of the verb cuıſım, which is still in common use. "Toċuſ, placing."—*O'Reilly.*

[104] ETRUM, between me: now edrum, or eadrum.

[105] ThRA, an expletive similar to the Latin *sane, autem*, or the Greek δι.

[106] NA, the, nom. plur. of the article an, ın.

[107] hUILE, all: *sic hodie.*

[108] NERT SO, these powers: *sic hodie*, but written neıſt.

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FRI[109] CECh NERT N-AMNAS[110] N-ETROCAR[111] FRISTI[112]
contra omnem potentiam hostilem sævam excogitatam

DOM[113] ChURP[114] OCUS DOMM ANMAIN,[115] FRI TINChETLA[116]
meo corpori et meæ animæ, contra incantamenta

SAIbḞATHE,[117] FRI DUbREĊTU[118] ZENTLIUChTA,[119] FRI SAIb-
pseudo-vatum, contra nigras leges gentilitatis, contra pseudo-

REChTU[120] hERETECDA,[121] FRI hIMCELLAĊT[122] N-IDLACh-
leges hæreseos, contra dolum idololatriæ,

TA,[123] FRI bRIChTA[124] bAN[125] OCUS ZObAND[126] OCUS DRUAD,[127]
contra incantamenta mulierum et fabrorum ferrariorum et druidum,

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[109] FRI, against, with. This preposition occurs in all the ancient MSS., and has various meanings, according to the noun which it governs.

[110] AMNAS, severe. "Ro ꝼeaꝼaꝺ caṫ aṁnaꝼ eꝺoꝼꝼa."—*Four Masters, passim.* "Aṁnaꝼ .i. ꝺoilig."—*O'Clery.*

[111] ETROCAR, unmerciful: now eaꝺꝼꝺóꝺaꝼꝼeach.

[112] FRISTI, prepared, or directed: now obsolete; but ꝼꝼeꝼꝼal, attendance, is formed from the root ꝼꝼiꝼ, or ꝼꝼeꝼ.

[113] DOM, to my; compounded of ꝺo and mo: *sic hodie.*

[114] ChURP, body: now chopp.

[115] ANMAIN, soul, dat. sing. of anam: *sic hodie.*

[116] TINChETLA, incantations. "Da ꝺeneꝺ ꝼoꝼꝼmeaċ ꝺo gniꝺiꝼ na ꝺꝼaiꝺe con tinchetlaib moꝼaib," two goodly fires the Druids used to make with great incantations.—*Cormac's Glossary, in voce* bellaine.

[117] SAIbḞATHE, false prophets: now ꝼaꝺbꝼáiṫe; Lat. *pseudo-vates.*

[118] DUbREĊTU, black laws: now spelled ꝺuꝺ-ꝼeaċꝺa.

[119] ZENTLIUChTA, of Gentilism or Paganism: now Zeꝺꝼlíꝺeaċꝺa.

[120] SAIbREChTU, *pseudo-laws*, false or bad laws: now written ꝼaꝺb-ꝼeaċꝺa.

[121] hERETECDA, of heresy, gen. of heꝼeꝼeꝺꝺ, heresy: now written eꝼiꝼeaċꝺ.

[122] hIMCELLAĊT: now obsolete. It literally means circumvention.

[123] IDLAChTA, of idolatry: now written ioꝺlaċꝺa.

[124] bRIChTA, incantations, spells, or charms: it is the plural of bꝼiꝼhꝼ, which, like the Latin, *carmen*, is used to express a poem and an incantation. "Oꝺuꝼ ꝺiꝺaiꝺ bꝼiċꝺa ꝺiꝺ ꝼoꝼ ꝼan ċꝼanꝺꝼiꝺ," he then pronounced incantations on that staff.—*Cormac's Glossary, in voce* neꝼꝺoiꝺ.

[125] bAN, of women, gen. plur. of bean, a woman: *sic hodie.*

[126] ZObAND, of smiths: *sic hodie*, but written ꝺobann, no, as has been already remarked, being used in ancient MSS. for the nn of the moderns. For an account of the incantations pronounced by Goibhne, the smith, on his staff, see a story in Cormac's Glossary under the word Neꝼꝺoiꝺ.

[127] DRUAD, of Druids: *sic hodie.*

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ꝑRI CECh ꝑISS[128] A RA ChUILIU[129] ANMAN ꝺUINI,[130]
contra omnem scientiam quæ occœcat animum hominis.

CRIST ꝺOMM IMꝺEꝴAIꞇ INꝺIU AR NEIM,[131] AR ꝬOS-
Christus me protegat hodie contra venenum, contra com-

CUꝺ,[132] AR ꝺAꝺUꝺ,[133] AR ꝴUIN,[134] CONOMChAIR[135] ILAR[136]
bustionem, contra demersionem, contra vulnera, donec meritus essem multum

ꝬOCRAICE.[137]
præmii.

CRIST LIM,[138] CRIST RIUM,[139] CRIST IM ꝺEꝴAIꝺ,[140] CRIST
Christus [sit] mecum, Christus ante me, Christus me pone, Christus

INNIUM,[141] CRIST ISUM,[142] CRIST UASUM,[143] CRIST ꝺESSUM,[144]
in me, Christus infra me, Christus supra me, Christus ad dextram meam,

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[128] ꝑISS, knowledge: now written ꝑıoꞇ.

[129] A RA ChUILIU, which blinds. "Coilleaó ꝛ. caoċaó."—*O'Clery.*

[130] ANMAN ꝺUINI, the soul of man: now written anam ouine.

[131] NEIM, poison: *sic hodie*, but the m is always aspirated.

[132] ꝬOSCUꝺ, burning: now written Ꝭoꞇcaó.

[133] ꝺAꝺUꝺ, drowning: now written ꝺáṫaó, or ꝺaṫaó.

[134] ꝴUIN, mortal wounding: *sic hodie.*

[135] CONOMChAIR. This is obscure in the MS., but its meaning seems sufficiently clear from the words which follow—ılar Ꝭocpaıce, much reward: until I deserve much reward.

[136] ILAR, much: now obsolete, but of constant occurrence in the Irish Annals, and explained in all the Irish dictionaries, glossaries, &c. "Iolaṁ ꝛ. ıomaꝺ: ıolaṁ ꝛluaġ."—*O'Clery.*

[137] ꝬOCRAICE.—See Note [a] *supra.*

[138] LIM, with me: now spelled ḃom. It is compounded of le, with, and me, me.

[139] RIUM, before me: now roṁam, but riu is written for roiṁ, before, in the best Irish MSS.

[140] IM ꝺEꝴAIꝺ, after me: *sic hodie*, but generally written am ꝺeaġaiḋ, or am ꝺıaiġ.

[141] INNIUM, in me: now spelled ionnam; it is compounded of inn, in, and me, me.

[142] ISUM, below me. This word is compounded of ꝼ, under, and me, me; it is now obsolete, but is explained by foum, now ꝼúm, under me, in the gloss on Bishop Sanctan's Hymn, preserved in the *Liber Hymnorum.*

[143] UASUM, above me: now obsolete. This word is compounded of uaṫ, above, and the pronoun me, me. It occurs also in Bishop Sanctan's Hymn: "ꝺennacht ꝺe aṫaiṁ uaṫum."

[144] ꝺESSUM, at my right: now obsolete; the modern phrase is oom ḋeıṫ. In Bishop Sanctan's Hymn the phrase ꝺıa ṫeṫṫum is glossed by the more modern form, ꝺıa ṫuṁ a noeṁ. It is a remarkable fact, as Dr. O'Brien has learnedly shown in his Irish Dictionary, that the Irish, as well as the Jews, used the same words to express the right hand and the south, the left hand and the north, the front and the east, and the back and the west.

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CRIST TUATHUM,[145] CRIST ILLIUS,[146] CRIST ISIUS,[147] CRIST I
Christus ad lævam meam, Christus hinc, Christus illinc, Christus a

NERUS.[148]
tergo.

CRIST I CRIDIU[149] CECH DUINE IMM IMRORDA,[150] CRIST
Christus [sit] in corde omnis hominis quem alloquar, Christus

I N-GIN[151] CECH OEN RODOM LABRATHAR,[152] CRIST IN
in ore cujusvis qui me alloquatur, Christus in

CECH RUSC NOM DERCAEDAR,[153] CRIST IN CECH CLUAIS[154]
omni oculo qui me videat, Christus in omni aure

RODAM CHLOATHAR.[155]
quæ me audiat.

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[145] TUATHUM, at my left. This word is still used in some parts of Ireland, but oom cli is more general. In Bishop Sanctan's Hymn it is glossed by fpim a cuicch.

[146] ILLIUS: now obsolete.

[147] ISIUS: now obsolete.

[148] I NERUS, at my back: now obsolete. This form of prayer, namely, placing God and the persons of the Blessed Trinity at the right, left, above, below, &c., is still in use among the Irish, and found in the most ancient MSS., as in Bishop Sanctan's Hymn, already referred to, and in an old hymn preserved in the *Leabhar Breac*, thus: "Criſe fóm, Criſe bum chino, Criſe ceécair oom éoeb, com éiriże, com cliab, riġ nime na noeb." Also in Maelisu's Hymn, preserved in the *Liber Hymnorum*: "In Spirut Noeb immunn, imunn ocup ocunn; In Spirut Noeb éuccunn; In Spirut Noeb o'airgeb ar cuirp ir ar n-anma; ocur fiadóid co rolma ar żábuż, ar żalma," &c.

[149] CRIDIU, heart: now written croiże in Ireland, but *cridhe* in the Highlands of Scotland.

[150] IMRORDA: now obsolete, but explained in an old glossary quoted by O'Reilly: "Iomporour, I said; tomrapoarpioo, they said."

[151] GIN, mouth. "Żion .i. béal."—*O'Clery.* "Nim cpuime a n-żion żoa .i. bpiaon bpúżeas a mbéal na paipże."—*Idem.* Welsh, *geneu*, mouth.

[152] RODOM LABRATHAR, who speaks to me. This form is now obsolete, and is peculiar to the dialect called *Bearla Feine*. The verb labpaim, I speak, is still the word used in Ireland, but it is inflected differently. Ro luom labpar is the nearest form to this which would now be understood. Ar labpaiżeap is another form found in the best MSS., to express who speaks.

[153] NOM DERCAEDAR. This form of expression is now obsolete, but the verb oeapcaim is still well understood. Nom' oeapcaiżeap is another ancient form of this phrase.

[154] CLUAIS, dat. form of cluar, the ear: *sic hodie.*

[155] RODAM CHLOATHAR, that hearkens to me. This phrase is also obsolete in the modern Irish, but is explained in the old Irish Glossaries. "Cloéa .i. cloirom: no cloéa .i. oo clor no oo cuaiłaż."—*O'Clery.* Rom' élumeiżeap, is another ancient form of this phrase.

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A TOMRIUG INDIU NIURT TREN TOGAIRM TRINOIT.
Ad Temoriam hodie potentiam præpollentem invoco Trinitatis.

CRETIM TREODATAID FOISIN OENDATAD IN DULEMAIN
Credo in Trinitatem sub ꝛꝛ Unitate ꝛꝛꝛ numinis

DAIL.
elementorum.

DOMINI EST SALUS, DOMINI EST SALUS, CHRISTI EST
Domini est salus, Domini est salus, Christi est

SALUS, SALUS TUA, DOMINE, SIT SEMPER NOBISCUM.
salus, salus tua, Domine, sit semper nobiscum.

HYMN OF ST. PATRICK.

At Temur to-day I invoke the mighty power of the Trinity. I believe in the Trinity under the Unity of the God of the Elements.

At Temur to-day [I place] the virtue of the Birth of Christ with his Baptism, the virtue of his Crucifixion with his Burial, the virtue of his Resurrection with his Ascension, the virtue of the coming to the eternal Judgment.

At Temur to-day [I place] the virtue of the love of Seraphin; [the virtue which exists] in the obedience of angels, in the hope of the Resurrection to eternal reward, in the prayers of the noble fathers, in the predictions of the prophets, in the preaching of the apostles, in the faith of the confessors, in the purity of the holy virgins, in the deeds of just men.

At Temur to-day [I place] the strength of heaven, the light of the sun, the whiteness of snow, the force of fire, the rapidity of lightning, the swiftness of the wind, the depth of the sea, the stability of the earth, the hardness of rocks [between me and the powers of paganism and demons.]

At Temur to-day may the strength of God pilot me, may the power of God preserve me, may the wisdom of God instruct me, may the eye of God view me, may the ear of God hear me, may the word of God render me eloquent, may the hand of God protect me, may the way of God direct me, may the shield of God defend me, may the host of God guard me against the snares of demons, the temptations of vices, the inclinations of the mind, against every man who meditates evil to me, far or near, alone or in company.

I place all these powers between me and every evil unmerciful power directed against my soul and my body, [as a protection] against the incantations of false prophets, against the black laws of Gentilism, against the false laws of heresy, against the treachery of idolatry, against the spells of women, smiths, and Druids, against every knowledge which blinds the soul of man. May Christ to-day protect me against poison, against burning, against drowning, against wounding, until I deserve much reward.

Christ [be] with me, Christ before me, Christ after me, Christ in me, Christ under me, Christ over me, Christ at my right, Christ at my left, Christ at this side, Christ at that side, Christ at my back.

Christ [be] in the heart of each person whom I speak to, Christ in the mouth of each person who speaks to me, Christ in each eye which sees me, Christ in each ear which hears me.

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At Temur to-day I invoke the mighty power of the Trinity. I believe in the Trinity under the Unity of the God of the elements.

Salvation is the Lord's, salvation is the Lord's, salvation is Christ's. May thy salvation, O Lord, be always with us.

That this hymn is the real composition of St. Patrick it might be difficult to prove satisfactorily; but that it was considered as his in the seventh century, and is at least a composition of the highest Christian antiquity, can perhaps be proved in as satisfactory a manner as any question of this kind could admit of. Of this early antiquity evidences have been already adduced, to which it may be added that this hymn is distinctly alluded to in Tirechan's annotations on the saint's life, written in the seventh century, and preserved in the Book of Armagh, in which it is stated that his *Irish* Hymn ought to be sung for ever:

"Patricius sanctus episcopus honorem quaterna [quaternum ?] et omnibus monasteriis et ecclesiis per totam Hiberniam debet habere, id est.

"I. Sollempnitate dormitationis ejus honorari in medio veris per .iii. dies et .iii. noctes omni bono cibo præter carnem quasi Patricius venisset in vita in hostium [hospitem ?].

"II. Offertorium ejus proprium in eodem die immolari.

"III. Ymnum ejus per totum tempus cantare.

"IIII. *Canticum* ejus *Scotticum* semper canere."—*Book of Armagh*, fol. 16, p. a, col. 1.

But perhaps the strongest proofs of its antiquity are those derived from the internal evidences furnished by the hymn itself, which is so tinged with pagan allusions as to indicate a period for its composition antecedent to the full development of the Christian doctrine in the country. A Christian living after the establishment of Christianity would hardly invoke the Deity to protect him from the spells of *women, smiths*, and *Druids;* and that part of the prayer in which the saint places the natural properties of the Creator's works between himself and the powers of evil can find no parallel in any later Christian authorities. Indeed, on this account, and from a comparison of the hymn with those confessedly composed in Ireland in the fifth century—for example, the one composed in praise of Patrick by Secundinus—it may be questioned whether this production would be regarded as orthodox in times subsequent to the assumed period of its composition; and hence perhaps the remarkable fact, that in all the more modern lives of St. Patrick no allusion is made to it, but rather to the hymn of Secundinus, to the repeating of which, though in Latin, and of considerable length, were annexed the same blessings as those promised to such as should repeat the Hymn of

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Patrick. Nor is it easy to conceive any other reason why Colgan, who must have had a copy of it in his possession, takes no farther notice of it than stating in his list of the Saint's works, that such a hymn was composed by Patrick. But, notwithstanding this silence of writers for so many centuries on this document, it is remarkable that the *Luireach Phadruig* is still remembered popularly in many parts of Ireland, and a portion of it is to this day repeated by the people, usually at bed-time, with the same confidence in its protecting power as, according to St. Evin, was placed in it previously to his time.

Though the subject is of great interest, it would be too great a digression from the purpose of this memoir to illustrate the belief in the magical powers attributed in this hymn to *women*, *smiths*, and *Druids*; but it may be shortly stated, that there is abundant evidence of the continuance of such superstitious credulity, not only in the Irish accounts of succeeding ages, but also in the popular belief of the people in several parts of Ireland, to the present time.

In connexion with the history of Tara at this period, two very important events are stated by the modern historians generally, of which it will be necessary to take some notice here, with a view to ascertain their claims to credibility. These events are: 1. The compilation of a great work called the *Seanchus Mor*, which consisted of the ancient historical records and laws of the country, purified from error by a committee of nine persons, consisting of three kings, three bishops, and three bards or antiquaries; and, 2. The burning, by St. Patrick, of the books in which the mysteries of the Druids were preserved.

I. For the first of these statements the authority usually relied on is the following record in the Annals of the Four Masters:

Coir Cpipt ceitpe céo cpiocha a hoche. An deachmad bliadain do Laoghaipe. Seanchup agup Fénechup na h-Epenn do glanad agup do pcpiobad an dreaclamad pepeapcpad agup peinleadap h-Epenn co haonmaighi an impidi naoiñ Patpaice. Ceatp hane po na naoi paiḃe pochaideachai lap a noepnad ino pin .i. Laoghaipe .i. pi Epenn, Copcc agup Daipe an epiúp pioġ; Patpaice, Benen, agup Cáipneach, an epiúp naoiñ; Rop, Dubthach, agup Feapgup, an epiúp peanchaḋ, aiñm deapḃup an pann—

A.D. 438, the tenth year of Laogaire. The *Seanchus* and *Fenechus* of Ireland were purified and written, the writings and old books of Ireland having been collected together at the request of St. Patrick. These are the nine supporting props by whom this was done, namely, Laoghaire, i. e. King of Ireland; Core and Daire, the three kings; Patrick, Benen, and Cairneach, the three saints; Ross, Dubhthach, and Feargus, the three antiquaries, as this quatrain testifies—

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Laogaire, Corc, Dáire dúr,	Laogaire, Corc, Daire the stern,
Patrick, Benen, Cairneać cóir,	Patrick, Benen, Cairneach the just,
Ros, Dubḃach, Fergus go feḃ,	Ross, Dubhthach, Fergus with goodness,
Naoi railġe rein Seanchuis móir.	The nine props these of the *Seanchus Mor.*

As, however, it is not from the original Irish of the Four Masters, but from Colgan's translation of it, that subsequent Irish writers have formed their conclusions as to the nature of this work, it should be stated that Colgan renders the words Seanchus and Fenechus Erend, *Hiberniæ Antiquitates et Sanctiones Legales:* but, although this honest writer rendered these words accurately according to the sense in which they were understood in his time, it will be presently shewn that the accuracy of his translation may be very open to doubt. That the truth of this record of the Four Masters should have been unquestioned by modern writers will excite no surprise, when it is considered how customary it was with them to copy from one another without inquiry, or, as it is expressed by Toland,—who was, notwithstanding, himself the greatest of sinners in this way,—eternally to serve up the same dishes at every meal. But it could not escape the critical honesty of Dr. Lanigan that this statement is quite inconsistent with the true history of the times. This able writer thus speaks of the *Seanchus Mor*, which he says was foolishly ascribed to St. Patrick by some of the antiquaries :—"They tell us it was compiled in the year 439, and that St. Patrick was assisted in this mighty undertaking by two holy bishops, one of whom was Benignus, three kings, and three antiquaries, who, according to this notable history, formed the famous *Committee of Nine*, appointed for this purpose by the senate, called the *Fes* of Temor or Tarah. So then St. Patrick and other ecclesiastics would have been members of the national assembly of Ireland, and that at a time when the far greatest part of the persons entitled to sit in it were Pagans. Would king Leogaire, who was never a Christian, have allowed a place in that meeting to a foreigner, or, what would be still more strange, recognized his authority? And how could Benignus have been a bishop in 439, or even a senator, and chosen on a committee? In that year St. Patrick was better employed, preaching in Connaught, than in attending senates. The mixture of ecclesiastics with laymen in the states-general of nations was quite unknown in St. Patrick's days. What has become of the *Seanchas More* is uncertain."—*Eccl. Hist.* vol. i. p. 371.

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It would be difficult, if not impossible, to answer some of these objections, and others of still greater force might have been added; for example, the impossibility of Corc, King of Munster, having been one of three kings constituting this committee, when it appears from the concurrent testimony of all the Irish histories that he must have been dead long before the period of its supposed formation, as his grandson, Aengus, was the contemporary of Laoghaire, and the first king of Munster converted to Christianity by St. Patrick. And in like manner St. Cairneach could not have been of this committee, as he was the cousin and contemporary of the monarch Muircheartach Mac Erc, who died in 534, and as his own death is placed by Colgan about the year 530. To these objections might be further added the facts that all the ancient lives of St. Patrick, with the exception, perhaps, of that compiled by Jocelyn in the twelfth century, are silent respecting this work, and that the most ancient accounts preserved by the Irish respecting its origin shew that it is involved in great obscurity.

It is, notwithstanding, certain that the Irish had a work called the *Seanchus Mor*, of which portions, if not the whole, are still preserved; and that the tradition respecting its supposed authors is of an antiquity anterior to the ninth century. It is quoted several times in Cormac's Glossary, and the same account of its origin is given in that work under the word Noiꝼiꝛ, or knowledge of nine, as that already extracted from the Annals of the Four Masters; and it is also frequently quoted, and referred to Patrick's time, in the Brehon Laws of later ages. The antiquity of the *Seanchus Mor* is therefore beyond a doubt; but as the character of this work, and its probable age, are questions which have been hitherto left in nearly total darkness by all the modern historians, it may not be wholly improper, even at the hazard of a slight digression from the immediate object of this paper, to take the present opportunity of investigating a subject of so much historical interest.

And, first, with respect to the nature of the work, the clearest evidences will be derived from the ancient prefatory accounts prefixed to fragments of it still preserved in the Manuscript Library of Trinity College, Dublin, (Class H. 3. 17; and H. 3. 18,) which are here presented to the reader with as literal a translation as the idiom of the English language will allow.

Caite locc, ocuꝛ aimꝛiꝛ, ocuꝛ tucaiꝛ ꝛcꝛiḃinꝺ, ocuꝛ peꝛꝛa ꝺo'n t-Senchuꝛ maꝛ?	What is the place, and time, and cause of writing, and author of the Senchus Mor?

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Locc oo, Niah, ap in conpiche i po lazat na genee ano fri Patraic. Cimpep oo, i flaiżup in piġ Laeġaipi Mic Neill. Peppa oo, Fepgup pilió, ap paée puanemain pou la Patpaic hap eaźéaim a n-Epinn. *Dicunt alii* Temuip ocup Laoġaipi, ocup Dubżać mac U Lugair, pi-filió inpi Epeno. Opo oepioh oiġe na epeomi la pipu Epeno, ocup po pmeáó poipceél Chpiſe oáiḃ uile, ocup po puiaiżeo Laoġaipe com opuiżaiḃ eſe pipeu ocup mipḃuili oepmaipe oo puġne Patpaic i piaṫnuiṫ pep n-Epeno; gunca hapum po epeiżpie ocup popuipżeup oiġnép Phaetpaic, ap po żonżpa huaṫ popmna pep n-Epeno oo żuiseażć in oen inaṫ fri aonżaio n-imożalla ma im copup a m-bepcna ocup a pechea; ocup oo cuap uaiḃ co Patpaic, co tainchiopeo oon oail. A lażé oin pia enaċheain oo Phaetpaic cucu imur nap laiżeap fip Epeno aeuppu im a n-eżap. Cio epa, ol Laeġaipe ppiu, ap annpam lib po pmeáżao in clepeć ouib? Nin. cain oilżuo, ap ipe, ár in uain żebup caċ ouine ceill pop oilżuo oo neoć oo żenó oe ule, ni bia comup pop pogluib ocup żonaio caċ pep aianle, &c. Cio oin oo oenum fpiptin? Ipżeo aipic mo aipic pa oe, ol Laoġaipe, máp t Bup coiheple pi, ppomchup a aigneo péipn, .i. żonéap neć bia muniṫip ap a beluib; maoa loġa, bemione fpiṗ in peche pin; manca oilżeo oon, &c.

Ro puiuiġáo, oin, a comaipli Laoġaipe ocup pep n-Epeno, pep punpaiż oo żuin map ao bui ap beluib Patpaic amail oo nicpeo an oail: *quod completum est* epi piaṫ Laeġaipe. Iap pin, oin, po bié in pep oo muniṫip Patpaic ap a żnuip oż eaplim ipin cathac. Oo peccae Patpaic puap oo cum a pochpaiei; Zapain po żab epiṫ ocup ealum-cumpcugao map inpi n-Epeno ocup a pipu,

Its place is *Nith*, [so called] from the contention which the Gentiles had there with Patrick. Its time, in the reign of Laoghaire Mac Neill. Its author, Fergus the poet, who joined Patrick after his arrival in Ireland. Others say Temur and Laoghaire, and Dubhthach Mac-U-Lugair, royal poet of the island of Ireland. When the purity of the faith was acknowledged by the men of Ireland, and when the Gospel of Christ was preached to them all, and when Laoghaire, with his Druids, was defeated by the great wonders and miracles wrought by Patrick in the presence of the men of Ireland, it was then they believed and did the will of Patrick, who requested of them that the choice part of the men of Ireland should come to one place to hold a conference respecting the justness of their covenants and laws; and messengers were sent by them to Patrick [to state] that they would go to the assembly. The day before Patrick went to them, the men of Ireland conferred on the subject of their meeting. Why, said Laoghaire to them, does what the Cleric has preached to you seem difficult? They replied, The law of forgiveness is so, for when every one is convinced that what he does of evil will be forgiven, there will be no power over plunderers, and one man will stab the other, &c. What, then, shall we do with him? My advice is this, said Laoghaire, if it meets your approbation, let his own mind be proved, that is, let one of his people be wounded before his face; if he forgive, we will agree with that law; if he does not, &c.

It was then agreed upon in the council of Laoghaire and the men of Ireland, that a certain person of Patrick's people should be wounded before his (Patrick's) face, when they should approach the assembly, which was done at the request of Laoghaire. After this, then, one of Patrick's people was wounded in the face as he was descending from the chariot. Patrick went up to the crowd, upon which the island of Ireland shook

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ocup ro la in pluag bui ip in oail cap a ceann. *Et timuerunt timore magno, et facti sunt velut mortui*, &c. Capn oin, pleéeap Laogaipe ocup fopmnai noagoume n-Epenn fop oigpiup n-De ocup Paepaic. Aimne, aimne, a cleipig, olbaio pip Epenn, po ppiuchepeap oibge! Maiż, em, ol Paepaic, pebuic uili pip Epenn: pauic iapum pip Epenn pri Paepaic *ut dictum est*, cabap comaiple pain. Ip iap pin iapum ap bepe Paepaic, po cepo-pa, epa, ol pe, a pep pigpiuo inp Epenn .i. Dubéach Mac U Lugair, leipeap lán oo pach in Spiaeu Naimh. Maiż, em, ol Dubéaé; ouipcinn ouile a pao pinum, a cleipig, ol Dubéaé, ip amnup oam beé ip in oail pin pep Dia ocup ouine .i. áp maéeé ar béipa nem-epic in gnimaipa bep bio olc ooc inéaib-piu, ocup ni bae po lae; maéeé, oon, ap bép a epic ocup a mnechlann bep ni ba maiż la eu pon oon, áp ipeé pil i poipeelai og-aibgue caéa uile ho caé comneipum ova laile. Maiż epa, ol Paepaic, an oo bepa Dia pop é'epiabpaz paib. *Amen, non vos estis qui loquimini, sed spiritus patris vestri qui loquitur in vobis*, &c. Ni pib buoeim laibepup aée ppiuc m'aéap a eu mneih laibepup uaib. Oennachuip iapum Paepaic a gin fuiri, ocup oo luiö paeh in Spiaeu Naimh pop a epiabpa conoepepe,

"In euch i ngnieleche," &c.

Rogam a ler epa, olbaio pip Epenn, fuiö-iugaö ocup opouğaö each pechea lino cio cinmoea inipeo. Ip ferp, ol Paepaic, a benam, ocup ip annpin faipcomla each aoi pana la h-Epinn, co euipren each a cepo pao Puiccpaic ap beluiö each plaeha la h-Epinn: ip ann po herbao oo Dubchach euipreniao brechemnuiu ocup a uili pilioechea Epenn and quaked, and the men trembled, and the host which was at the assembly came to meet him. And they feared with a great fear, and became as dead men, &c. Upon this Laoghaire and the choice of the men of Ireland submitted to the will of God and Patrick. Patience! patience! O! cleric, said the men of Ireland, you have preached forgiveness. Very good, said Patrick, let all the men of Ireland consider it. The men of Ireland then said to Patrick, as it is said, Give advice upon it. It was after this that Patrick said, I will leave it to the decision of the royal poet of the island of Ireland, that is Dubhthach Mac-U-Lugair, a vessel full of the prosperity of the Holy Spirit. Very good, said Dubhthach; it is severe in thee, O, cleric, to say so to me; it is disagreeable to me to be in that decision between God and man; for if I say that no *eric* is to be given for this deed, it will be evil for thy protection, and thou wilt not deem it good; and if I say that *eric* and mulct are to be given for it, God will not deem it good, for it is in the Gospel that full remission for every evil is to be given by one neighbour to another. Very good, said Patrick, God will say to thy decision, "*Amen, non vos estis qui loquimini, sed spiritus patris vestri qui loquitur in vobis*, &c." It is not ye that speak but the spirit of your* Father which speaketh in you.† Patrick afterwards blessed his mouth, and the prosperity of the Holy Spirit descended upon his eloquence, and he said,

"In euch i ngnieleche," &c.

We require, said the men of Ireland, to settle and arrange every other law whatever among us as well as this. It is better, said Patrick, to do so; and it is then that the professors of each science in Ireland came forward, and each explained his own art to Patrick in the presence of every chief in Ireland; and Dubhthach was told to explain the judicature and all the poetical compositions of

* In the Irish it is incorrectly translated m'aéap, *of my father.*

† Quoted from Matth. x. 20.

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ocup necha pechea po fallnarpae la peraib Ereno hi peche aicnio, ocup hi peche ranói, ocup fileoib. Ocup na ranói anpeechnaiap oo iepa in berla mban mbuain .i. Canoin; ap in Spipae naem po labpupaip ocup oo anpeéainn epia ginu na pep Eipeon ce oo rabaeap i n-inip Ereno, amail oon anpééainn epia ginu inna primpaióiu ocup inna n-uaral aiénech i peche Peeapbaice; ár po riache peche aicnio map na poche peche liepe ina bpiaéra De. Fipaeinió epa oin po labpaeaip in Spipae naoiu epe ginu bpeéemon ocup fileó Eipeon pep n-Ereno, o congbaó in inip peo co epeoeamh anall; oar aippén Dubchach uile oo Paepaic in ni oin na eaeéaio pri bpeiip n-De i peche liepi, ocup Nuapiaónuip, ocup pri coibnea epaipion.

Conaipgeo in oipo bpechemnaca la Paepaic, ocup Secaip ocup flaiéi Ereno, oo neoch po baoi peche aicnio uile inge epoeom ocup a coip, ocup a comuaim n-eclaip pri eaeaé; conio he Senchup Mop anopin.

Nonbup epa oo epglaiz oo opouzao in liubaip pin .i. Paepaic ocup Benignup ocup Cairneé, epi h-Eippuic; Laegaipe Mac Nel, ocup Dairi pi Ulao, ocup Core Mac Lugaich ó Muiman, na epi piġi; Dubchaé Maoc U Lugair, ocup Rop Mac Trechim, pui berla Féine, ocup Fergup, na epi pilea. Nopip oin, amm in liubaip po hopouzpao .i. pip nanbuip, &c. Ip i, epa in Cain Paepaic: ipreo nao cumaing neé bpeéem boenaie oo Zaeoelaib oo eaeéneé nech ni po zaba i Senéup Mop.

Co tainic Paepaic epa ni eabupcha uplabpa aéc oo epiup a n-Eipinn: pep coigne, pri h-aipner ocup peélózao, pep cepoi pri molaó, ocup aip, bpeehem pri bpechemnuip ó Roiceaó ocup Fapach [.i. pip oš in Éireland, and every ordinance used by the men of Ireland in the law of nature, and in the law of the Magi and Fileas. And the Magi had foretold the coming of the bright language of life, i. e. the Canons; for the Holy Spirit had spoken and sung through the mouths of the just men who were in the island of Ireland, as he had spoken through the mouths of the chief prophets and noble fathers in the Old Law, for the law of nature had reached where the law of the letter and of the word of God had not penetrated. The Holy Spirit, indeed, had spoken true wisdom through the mouths of the Brehons and just Fileas of the men of Ireland, from the [first] colonization of the island until [the establishment of] the faith; and Dubthach shewed to Patrick all that would not agree with the word of God in the written law, the New Testament, and the confession of faith.

Such of the order of the Brehons, and of the church, and of the nobility of Ireland as adhered to the law of nature, were all converted by Patrick to faith, to justice, and to harmony of church and laity, and that is the Senchus Mor.

Nine persons were appointed to prepare this book, namely, Patrick, and Benignus, and Cairnech, three bishops; Laogbaire, the son of Nial, and Dairi, King of Ulster, and Core, the son of Lughaidh of Munster, the three kings; Dubthach, Mac-U-Lughair, and Ros Mac Trechim, Professor of the *Berla Feine*, and Fergus, the three poets. *Nofis* is the name of the book which they arranged, i. e. the Knowledge of Nine, &c. This is the *Cain Patraic:* and it is a fact that no individual Brehon of the Gaël has dared to abrogate any thing found in the *Seanchus Mor.*

Until Patrick came only three in Ireland were permitted to have *Urlabra*, namely, a Chronologist to relate events and tell stories, a *Fer Cerda* to eulogise and satirise, and a Brehon to pass sentence from the *Roscadh* and *Fasach** [the poetical

* For the difference between the Roiceaó and Fapach see Manuscript Lib. Trin. Col. Class H. 4. 22, p. 79.

nechuir]. O cainic imorru, ir roimam a ea coé uplabra oona hUib hIrtu do fer in berla Bain .i. na Canoine. O'n uair ronuc Amorgein Glun-gel céo breé in-Erinn ro bai la Fileanb anaonup bpeehemnuf cuf in imacallaim in da euarpe i n-Emuin Macha .i. Fercertene ocup Neide Mac Conu, ima euigin fuad Bai ag Conu Mac Cuithir. Da aorcha an in labra ro labuppee na filid ir an furgell rin, ocup nip ba pell oo na flaithib in bpeehemnup ronuc-rato. Ir lar na feprib ri anaenup a m-breé ocup a n-eolup olcaa na flaithi. Ir oo'n gabi oondo rime leo, "ni euice mne cedamur apranroe." Ir inn oon, ol Concobar biaio cuio oo cac ann rum o noiu, acé an breé ouéaig oobrum oe, nip piefe amail. Zebaio each a brechea oe.

Do allro oin bpeehemnar ap fileanb nche a n-oucaig oe, ocup ro gab each oe feprib Erenn a bpeche oen bpeehemnar, amail ro gabrar bpecha Eochai Mic Luéca, ocup bpecha Fachtnai Mic Sencha, ocup gabpecha Capuomaé Mic Tepcéi, ocup bpecha Morainn Mic Main, ocup bpecha Eogain Mic Duirpeeche, ocup bpecha Doee Menchem, ocup bpecha Brigi m-Dui, ocup bpecha Diancecte o legaib, ge ro baeup riae reup, &c.

Ir in aimpir rin oo mioeuf maiéi fer n-Erenn eomur nae ocup imrce oo each iar na maioimlaée ro gabrao ir na breaib Neimeo, &c. Iar fenchamb na Zanbilgi in ro anuar; iar fencup in ecna aeai ro fir, &c.

and common law]. Since his arrival, however, the privileges of these professions are under the control of the man of the pure language, that is, the man of the Canons. From the time that Amorgin Glungel passed the first sentence in Ireland, the judicature belonged to the Fileas alone until the contention happened between the two sages at Emhain Macha, namely, Fereertne and Neidhe, the son of Adhna, for the professor's robe which had belonged to Adhna, the son of Cuithir. Obscure indeed was the language which the poets spoke in that disputation, and it was not plain to the chieftains what sentence they pronounced. "These men," said the chieftains, "have their sentence and knowledge to themselves," and, among other complaints enumerated by them, added, "We do not, in the first place, understand what they say." Then said Concobar, all shall partake in it from this day forward, but that part of it which is meet for these [the poets] shall not be transferred to any other. Each shall have his part of it.

The poets were then deprived of the judicature, except that part of it which was meet for them, and each of the men of Ireland took his own share in it, as did the authors of the following judgments, namely, the judgments of Eochy Mac Luchta, and the judgments of Fachtna Mac Sencha, and the false judgments of Carudmath Mac Tesethi, and the judgments of Moran Mac Main, and the judgments of Eogan Mac Duirthecht, and the judgments of Doet Memthem, and the judgments of Briga Bui, and the judgments of Diancecht of the physicians, but these [last] had existed before this period, &c.

At this time the chiefs of the men of Ireland made a classification of all, men and women, according to the dignity they received in the *Bretha Neimheth*, &c. The proceding is according to the Irish historians; the following is from the Philosophical Senchus, &c.

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The treatise then goes on to explain conjecturally the etymological meanings of the word *Senchus*, and afterwards the technical law terms used in the work.

A similar account of this work is given in another ancient MS. in the College Library, Class H. 3. 17, formerly the property of the celebrated Duald Mac Firbis; but in this account the miracles of St. Patrick are omitted, and the place and time of its composition are thus stated with greater distinctness:

Loce, ocup aimṙiṙ, ocup peṙṙa, ocup cuc-uiṙgnibinn in e-Senchuṙa: loce oo, Temuiṙ i ṙumṙao ocup i ṙoġmuṙ (.i. ap a glaine ocup ap a haiḃne,) ocup Raiṫ Ġhuéapo i ngim-piu ocup i n-Eṙṙuch. (.i. iṙ uime ṙo bíoṙ a Raiṫ Ġhuéapo ap ġaine leo a connaiḋ ocup a huiṙci, ocup ap a ceapaiġeche .i. paiṫ in-aiṙcetha neċ inn ġué naṙo, no ina ġué molġ-éué; no o ġoṫaiḃ na naṙe .i. na laoċ, no o ġoṫaiḃ na naṙo .i. na n-uaṙal.)

The place, and time, and author, and cause of writing the Senchus. Its place Temur, during summer and autumn, (i. e. from its cleanness and amenity,) and *Rath-Guthaird* during the winter and spring. (They remained at *Rath-Guthaird*, from the convenience of its fire-wood and water, and from its sheltered situation. *Rath Guthaird* means Rath of the punishment of a person for his loud voice or for his unlawful voice; or it may have been named from the voices of the *arts* i. e. heroes, or from the voices of the *avds*, i. e. the nobles.)

Ap bṙú Nieṫ Nemanche (.i. Nieṫ ainm ḃo'n aḃainn, no iaṙṙa nieṫ oo ṙinṙiṫ na ḃṙuiḃe ṙe Paṫṙaic ann .i. ap in conṙluiche no nieżuin ḃo ṙinneó ina ṙaṙṙa ann. Nemanche .i. Nemanḃach hi iaṙṙ in ni ṙogeb-ḃuiṙ miłł nemaiḃ inuḃ, no, nemṙoinomech hi, iaṙṙ inni na ṙaḃuiġchuṙ romaine eṙce na coṙao inee.)

The place, and time, and author, and cause of writing the Senchus. Its place Temur, during summer and autumn, (i. e. from its cleanness and amenity,) and *Rath-Guthaird* during the winter and spring. (They remained at *Rath-Guthaird*, from the convenience of its fire-wood and water, and from its sheltered situation. *Rath Guthaird* means Rath of the punishment of a person for his unlawful voice or for his unlawful voice; or it may have been named from the voices of the *arts* i. e. heroes, or from the voices of the *avds*, i. e. the nobles.)

On the brink of *Nith Nemanach*. (i. e. *Nith* is the name of the river, or it was so called from the *nith* which the Druids made there with Patrick, i. e. from the conflict or contention made there with him. *Nemanche*, i. e. *Nemandach*, or pearly, from the fact that lumps of pearl were found in it, or *Nemhshoinnmhech*, i. e. unprofitable, from the fact that no profit of fish or produce is found in it.)

Raiṫ Ġué aṙo inu ṙin in baile ieu Leoc Paṫṙaic inu i ngluinn na mboouṙ i bṙocuṙ ḃon Nieṫ Nemanḃach, .i. nemano, uaṙal .i. baile i noeṙṙaiṫe na huaṙal-nim.

Rath-Guthaird is the place where, at this day *Lec-Patraic* is situated, in *Glinn-na-mbodhur*, near the [river] *Nith Nemanach*. *Nemann* is noble, i. e. where they made the *uasal nim* [noble gems].

Ocuṙ aimṙiṙ ḃo, aimṙiṙ Laoġuiṙe Mice Neill, ṙi Eṙinn; ocuṙ Ceoṫoiṙi ṙoṙ aiṙoṙiġ in oomuin in ean ṙin, ocuṙ oeiṙmḃiṙeche aiṙ:

And its time, the time of Laoghuire, the son of Niall, King of Ireland; and Theodosius was Emperor of the World at that time, according to this quotation:

Paṫṙaic ḃo baiṫiṙ co lí
In aimṙiṙ Ceoṫoiṙi
Preṫéeṙ ṙoiṙceóła cin bṙaṫ
Do éuaiṙ muḃṫuaiḋ mac Miłeó.

Patrick baptized with glory
In the time of Theodosius;
He preached the Gospel without falsehood,
To the worthy people of the sons of Milé.

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Ocup peprra oo, noi peprrant in e-renchuru, ocup oeirmbineche ain:

Laoȝaire, Core, Daire oup,
Patraic, Binen, Cairnech coir,
Ros, Dubthach, Fergup co feib
Noi rainȝe rin Senchuip mop.

In tan oo bron inonbup ann, ip ann oo nio he, ocup in tan ba h-erbaoach rep oib, ip ann oo niorp na roicechu.

Ocup tucc[a]o a benum, Patraic oo eaoeche i n-Eirinn oo rlaiȝ baithi ocup creitme .i. ipnomaiȝ bliaȝain planchuru Teoroirr, ocup ipin ceathruma bliaȝain fl nathuru Laoȝuire mic Neill, ri Erenn.

Ip e tin imurcep Patraic oo ȝeic a n-Eirinn oechnebup, ap ein ricelb, no oechnebup ap richie, ȝup cairpȝerree a opuiche oo Laoȝuire Patraic oo eiachtain a n-Eirinn, ocup ip anlurd po cairpȝerree:

Tiuçraiò Tailȝinn, oar muir mergnn,
A cpoinn cpoimcinn, a cinn coillcinn,
A miara i n-operher a eiȝi
A oépuiz oile amen, amen.*

And its author, the nine persons of the Senchus, according to this quotation:

Laoghuire, Core, Daire the sturdy,
Patrick, Binen, Cairnech the just,
Ros, Dubhthach, Fergus with goodness,
The nine props these of the Senchus Mor.

When these nine met together they compiled it, (the Senchus,) and when one of them was deficient, they made a subdivision of the work.

And the cause of its compilation was the coming of Patrick into Ireland to propagate baptism and faith in the ninth year of the reign of Theodosius, and in the fourth year of the reign of Laoghuire, son of Niall, King of Ireland.

The number Patrick is said to have brought to Ireland is seventy, or thirty; and his Druids foretold to Laoghaire, the coming of Patrick to Ireland in this form:

Tailgins shall come across the stormy sea,
With their crooked headed sticks, their shorn heads;
Their utensils shall be in the east of their houses,
And all shall say Amen, Amen.

* Whether this very ancient verse was really composed by the Druids of Laoghaire or not, it may be stated as a curious fact in support of its antiquity, that it is translated into Latin by Probus in his Life of St. Patrick, written in the tenth century, and by Mocuenius, who wrote in the sixth or seventh, and that both these writers state that the words of this little verse are obscure in consequence of the idiom of the language. Probus writes: "His, et aliis verbis magi illi concitaverunt tam Regem, quam omnem populum in odium S. Patricii Episcopi: et prophetando praecinebant in modum cantici lyrico modo compositi, ante adventum sancti viri duobus aut tribus annis decantantes de eo. Haec sunt autem verba cantici secundum linguae illius idioma in latinum translata, non tamen manifesta: Adveniet artis rapax, cum suo ligno praecurri capitis: ex eo omnis domus erit capite perforata, incantabit nefas ex sua mensa; ex anteriore parte domus suae respondebit ei sua familia tota; fiat, fiat. Quod nostris verbis potest manifestius exprimi: Adveniet totius artis magister cum signo suae crucis; et quod omne cor hominum compungitur: et de altari Sacramentorum convertet animas ad Christum: et omnis populus Christianorum respondebit; amen. Quando erunt haec omnia, tunc regnum nostrum gentile non stabit. Quod sic totum postea completum est. Eversis enim in adventu Patricii idolorum culturis, fides Christi omnia nostra loca ad adventum sanctissimi Spiritus replevit."—(*Trias Thaum.* p. 49, col. 1.)

And Mocutenius, after mentioning the prophecy of the Druids, thus alludes to the obscurity of the Irish verse: "Haec autem sunt versiculi verba pro lingua idiomo non tam manifesta. Adveniet Ascicput cum suo ligno curvi capite: ex sua domu capite perforato incantabit nefas a sua mensa; ex anteriore parte domus suae respondebit ei sua familia tota: fiat, fiat. Quod nostris verbis potest manifestius exprimi. Quando haec omnia fiant, regnum nostrum quod est gentile non stabit: quod sic potest ea [*recte* postea] evenerat. Eversis enim in adventu Patricii idulorum culturis, fides Christi Catholica nostra replevit omnia."—*Book of Armagh*, fol. 2, p. b, col. 1. It is also given in the *Tripartite*, and by Jocelin, who attempts an explanation of it.

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Ir i ro in chain Patraic ena, ocur nteó na cumuic nech bpechemain daanna do Gaedelaib do cairébiuć neć ni ro gebup a Senchup Mop.

This is the *Cain* of Patrick, and it is a fact, that no individual Brehon of the Gaels has dared to abrogate any thing found in the Senchus Mor.

The writer then proceeds, as in the former instance, to explain the etymological meanings of the word *Senchus*, of which the following will afford a sufficient specimen:

Dunad ocup inne ocup airbere connaidup don focul ar Senchup, .i. dunad do roene a Ebra, roene a Greic, no, raeno a Ebra rodra a Greic, *ratio* a Latin, dligeó a n Gaoideilg; ocup dligeó a airbere.

The root, import, and meaning of the word *senchus*. Its root is the Hebrew *soene* or the Greek *soene*, or the Hebrew *saeno*, in Greek *sossa*, which is *ratio* in Latin, and *dligheth* (law) in Irish; and its import is law.

It is also stated in these prefaces, as well as in many other very old Irish documents, that the ancient laws of the Irish previously to St. Patrick's time

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This very ancient quatrain is better given in the Life of Saint Patrick, preserved in the *Leabhar Breac*, thus:

"Tiagar tuillceno, tarr muir meirceno,
A bpaet toillceno, a cpann cpomceno,
A miar a n-airthep a éirge
Fpirceruc a muinter uli, amen, amen."

It is also given by the Scholiast of Fiech, and thus translated by Colgan in his *Trias Thaum.* p. 5, col. 2.

"Veniet tonsus in vertice trans mare vorticosum,
Cujus toga (i. e. cassula) erit desuper perforata, cujus baculus erit præcurvi capitis,
Cujus disci sive utensilia erunt in parte Orientali suæ domus:
Eique decantanti, tota ipsius familia respondebit *Amen, Amen.*"

A somewhat different reading of this verse is given in the Life of Patrick, preserved in the Book of Lismore, thus:

"Tiagrat tuillenn, tarr muir meirceann,
A m-bpuit toillceann, a cpainn cpoimceann,
A miara a n-airthep a eigi,
Fpirceruc uile, amen."

Immediately after this quatrain, another, wanting the fourth line, is introduced from the *Buile Chuinn*, [the phrensy of the Druid Conn,] in a Life of St. Patrick preserved in a MS. in Trinity College, Class H. 3. 18.

"Tiagrat tuilemo conuerac Ruama
Noiepir cella ceoiteige benoacha
Benchopuin aliraiż himbachla."

This is also translated into Latin by Colgan, as follows:

"Advenient cum circulo tonsus in capite; cujus ædes erunt ad instar solium Romanorum:
Efficiet quod cellæ futuræ sint in pretio et æstimatione:
Ædes ejus erunt angustæ et angulatæ et fana multa: pedum pastorale dominabitur."

Trias Thaum. p. 123, col. 2.

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had been called *Feinechas;* and some of these ancient etymological conjecturers suppose that the one was formed from the other by a *Ceannfochras,* or change of initials, but such conjectures are of very little value, as the words are obviously from different roots. The word *Feinechas* is evidently derived from *Feine,* a name very anciently applied to the Irish people, as appears from Fiech's Hymn; and hence the old language of Ireland, in which the laws were written, was called the *Béarla Féine,* and the old laws themselves are constantly called *Dlighthe na Féine.* In like manner the word *Senchus,* applied in this instance to express an ancient code of laws, but which the Irish themselves say would be applied with equal propriety to any other ancient writing, is obviously formed from the Celtic root *Sen,* old, ("ab eo quod est senex,"—*Cormac's Glos.*) which has direct cognates, not only in the Indo-European families of languages, but in the Semitic; for it is observable, that in Arabic *Sen* or *Senha* is used to signify old, ancient, while *Suna,* a word very similar in structure, is understood by the Arabs, Tartars, and Moguls, to mean that body of traditional laws which exists apart from the Koran.—See *Millius de Mohammedismo,* p. 54. "Arab. *Sunnah,* institution, regulation, &c.; Pers. *San,* law, right," &c.—*Richardson.* "*Sanna* Phoenicibus idem fuit quod Arabibus *Sunna,* lex, doctrina, jux canonicum."—*Bochart. Geogr. Sac.* l. ii. c. 17. Opp. Tom. i. col. 771. Lugd. Bat. 1712.

The preceding accounts of the *Senchus Mor* are, it must be confessed, like all the narratives of the middle ages, very largely tinctured with fable; but such documents furnish the only evidences of the history of remote times, and the truths on which they are grounded, should not be rejected because of the intermixture of the marvellous incidents and anachronisms with which they are blended. Indeed it often happens, that from such anachronisms and fables the truth is most easily elicited. Thus, while it appears certain from these accounts that the story of the Committee of Nine had no better authority than an old anonymous Bardic poem, and the question of authorship, even among the Irish themselves, was involved in great obscurity, it is equally certain that the *Senchus Mor* was not, as all the modern historians have supposed, a History or Chronicle of Ireland, but a body of the ancient laws of the country modified at some period subsequent to the introduction of Christianity, to agree with its doctrines; and this is corroborated by a quotation from the work, given in Cormac's Glossary under the word ɲeɼcóiɼ, as follows:

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Ner annm oo'n beim, ocur oo, n éréċe, *ut est* ir in e-Senchar Máp:

Cí ġráinib ceċ comar, a ṙéniḃ ceċ roṙar.

Cí moeniḃ ceċ meṙa, a oiriḃ cuipp ouine,
Cío ar ile puile, ro oroaiġeo ner.

Nes is the name of the blow and of the wound, as is in the *Senchus Mor*:

From grains every measure, from the *Feni* each science.

From *moeni* each *mes*. The fines for man's body
Are various according to the situation of the wound.*

A. Cináil ber urġnaéar in Bairl irin ouine a ṙuiṙmiżeṙ in éréċe, ir ṙoi oon biż an eṙaic: *verbi gratiâ*, maó in aġaiḃ, no in éoan, no in ṙmeic, ṙuiṙmiżeṙ ino aéaiṙ, ir móiḃe an éraic, cináil ro ġaḃ irin Senċur Máp; maó ro éeaċ ber in éneo, no in aineiṁ, ir lugu ron, &c.

That is, the *eric* is according to the exposure of the part of a man's body on which the wound is inflicted; for example, if the blemish be on the face, or on the forehead or chin, the *eric* is greater according to the *Senchus Mor*; but if the wound or blemish be under the clothes the *eric* is less, &c.

Hence also it would appear that the *Senchus Mor* is the work described by Jocelyn in the following words: "*Magnum etiam volumen*, quod dicitur *Canoin Phadruig*, id est, *Canones Patricii* scripsit; quod cuilibet personæ, seu sæculari, seu etiam Ecclesiasticæ, ad justitiam exercendam, et salutem animæ obtinendam, satis congruè convenit."—*Trias Thaum.* p. 214, col. 1.

On the whole, then, it may be safely concluded from the preceding evidences, that the *Seanchus Mor* was not, as Colgan and the subsequent writers supposed, a mixed compilation of history and law, but a body of laws solely; and though perhaps there is not sufficient evidence to satisfy an unprejudiced inquirer that the Apostle of Ireland had any share in its composition, or even that its origin can be traced to his time, little doubt can be entertained that such a work was compiled within a short period after the full establishment of Christianity in the country. It is even highly probable that St. Patrick, assisted by one of the bards, converted to Christianity, may have laid the foundation of a revision of such of the pagan laws and usages of the country as were inconsistent with the doctrines of the Gospel; and that such a work, when completed by the labour of his successors, was ascribed to him to give it greater authority with the people. And this con-

* From these ancient verses, the sense of which is exceedingly obscure, it may be gathered that the laws of the *Seanchus Mor* were, at least in part, preserved in the form of Bardic rhymes; and this inference will appear the more reasonable from a passage in the account given of the *Seanchus Mor*, in which it is stated that that work was in part composed of the *Dichedal Filedh*, or Lyrical Poems of the *Filea* or Bards, who, previously to the reign of Conchubhar Mac Nessa, in the first century, were, according to the Irish historians, the only Brehons or Judges. For an explanation of the above verse see manuscript Lib. Trin. Col. H. 4. 22, p. 19, and H. 2. 15, pp. 130, 131.

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jecture is supported by the Annals of Ulster, so remarkable for their accuracy, which record at the year 438 the composition of the *Chronicon Magnum*, or, as it is called in the original Irish, in the fine MS. of these Annals in Trinity College, *Seanchus Mor*, a statement most probably derived from the older Annals of Tighearnach, which are now defective at that period.

2. If, as has been shewn, there is not sufficient historical evidence to establish the fact of the compilation of the *Seanchus Mor* by St. Patrick, or the celebrated Committee of Nine, it follows that the statement with respect to the burning of the Druidical books by Patrick, as consequent on that supposed proceeding, cannot be sustained. Indeed, for this statement, which has been so much dwelt upon by Kennedy, Toland, O'Conor, and others, as an argument for the use of letters anterior to the introduction of Christianity, no ancient authority or reference has been found; and it appears to rest solely on an assertion of O'Flaherty, derived, as he states, from a letter addressed to him by the celebrated Duald Mac Firbis :—" Postremo Dualdus Firbissius patriæ antiquitatum professor hæreditarius ex Majorum monumentis, literis datis refert 180 Druidum, seu Magorum disciplinæ tractatus S. Patricii tempore igni damnatos."—*Ogygia*, p. 219. But though a careful search has been made, no such statement as that here attributed to Mac Firbis has been as yet discovered in any of the works of that antiquary.

In concluding this notice of the most important facts connected with Tara during the reign of Laoghaire, it may be briefly stated that it will be shewn from very ancient historical evidences, which will be adduced in the succeeding portion of this memoir, that Laoghaire was interred after the manner of the pagans, within his own rath, on the Hill of Tara.

II. *Oilioll Molt*, son of Dathi, the predecessor of Laoghaire, after being King of Connaught, succeeded, and, after a reign of twenty years, was killed by Lughaidh, son of Laeghaire, in the battle of *Ocha*, in the year 482 or 483 of the common era, as thus stated in the Annals of Ulster :

A.D. 482. *Bellum* Oche la Luġaiḋ Mac Laeġaire aġur la Muircheartach Mac Erca, *in quo cecidit* Alill Molt.

A Concobaro filio Nesse, usque ad Cormac, filium Airt, anni cccviii. A Cormac usque ad hoc bellum ccvi., ut Cuana scripsit.

A.D. 482. The battle of *Oche*, by Lughaidh, son of Laeghaire, and by Muircheartach Mac Erca, in which fell Alill Molt.

From Concobar, the son of Nesse, to Cormac, son of Art, 308 years. From Cormac to this battle 206, as Cuana has written.

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The Annals of Ulster, in the reign of this prince, record, from various ancient authorities, the celebration of the *Feis*, or supposed triennial assembly of Tara, as having occurred, according to some, in the year 467; according to others, in 469; and according to others, in 470; but as it can scarcely admit of doubt, that these entries, as the statements of the annalist imply, refer to the one meeting only, and as no subsequent record is found of the assembling of the *Feis* in this prince's reign, either in these or any other ancient authorities, it would appear certain that the meetings of Tara, if they were ever triennial, ceased to be so subsequently to the introduction of Christianity, and that these assemblies were held but once in the reign of each prince, or, if oftener, upon some important emergencies. Thus also, in the reign of Laoghaire, the same Annals record only one celebration of the *Feis Teamhrach*, namely, at the year 454; and that this was the only assembly of the kind held in his reign is clearly proved from the following entry at the year 461:—"*Leogaire filius Neill post Ceana* [cænam] *Teamro, annis vii. et mensibus vii. et diebus vii. vixit.*" Indeed these records sufficiently indicate that such assemblies were of rare and irregular occurrence; for, if they had been held annually, or in a triennial cycle, it is highly probable that the circumstance would not have been considered remarkable enough to require a distinct record. Hence, it may be remarked, a historical doubt worthy of attention must arise, as to the truth of the statement found in so many of the old lives of St. Patrick, that it was during the *Feis Teamhrach*, in 433, that the saint made his famous attempt to convert the monarch and nobility of Ireland. It should be stated, however, that in the oldest lives of St. Patrick, those preserved in the Book of Armagh, as well as in the original Irish MS. copies of the Tripartite Life, preserved in the *Leabhar Breac* and Book of Lismore, this meeting is no where called the *Feis;* and the statements made in all the lives, that the time at which it was held was the eve of Easter Sunday, sufficiently shew that it was not the great national assembly so called, which, according to all the ancient authorities, was always held at the feast of *Samhan*, or 1st of November. It may be further stated that the accounts given of this meeting concur in shewing that it was not a political assembly, as the *Feis* is stated to have been, but rather a religious festival for the celebration of the *Bel-tine*, or fire of *Baal*. Thus, to adduce one of many testimonies, there occurs in the Life of Patrick, by Mocutenius, the following passage:

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"Contigit vero in illo anno, idolatriæ sollempnitatem quam gentiles incantationibus multis, et magicis inventionibus, nonnullis aliis idolatriæ superstitionibus, congregatis etiam regibus, satrapis, ducibus, principibus, et optimatibus populi, insuper et magis, incantatoribus, aruspicibus, et omnis artis, omnisque doni [*recte* doli] inventoribus doctoribusve vocatis ad Loigaireum, velut quondam ad Nabcodonosor regem, in Temoria istorum Babylone exercere consuerant, eadem nocte qua Sanctus Patricius Pasca illi illam adorarent exercerentque festivitatem gentilem.

"Erat quoque quidam mos apud illos per edictum omnibus intimatus, ut quicumque in cunctis regionibus sive procul, sive juxta, in illa nocte incendisset ignem, antequam in domu regis, id est, in palatio Temoriæ, succenderetur, periret anima ejus de populo suo.

"Sanctus ergo Patricius sanctum Pasca celebrans, incendit divinum ignem valde lucidum et benedictum, qui in nocte refulgens, a cunctis pene plani campi habitantibus visus est.

"Accidit ergo ut a Temoria videretur, visuque eo conspexerunt omnes et mirati sunt: convocatisque senioribus et majoribus natu ['dixit ad eos Rex; quid est hoc? quis est, qui hæc tanta ausus est facere in regno meo? pereat ille de populo suo. Respondentibus autem omnibus Senioribus, et Majoribus natu'—*Probus,*] regi nesciisse illum qui hoc fecerit; Magi responderunt; Rex in æternum vive. Hic ignis quem videmus quique in hac nocte accensus est, antequam succenderetur in domu tua, id est, in palatio Temoriæ, nisi extinctus fuerit in nocte hac qua accensus est, numquam extinguetur in æternum; insuper et omnes ignes nostræ consuetudinis supergradietur; et ille, qui incendit, et regnum superveniens a quo incensus nocte in hac, superabit nos omnes, et te, et omnes homines regni tui seducet; et cadent ei omnia regna; et ipsum implebit omnia et regnabit in sæcula sæculorum."—*Book of Armagh*, fol. 3, p. b. col. 1 & 2.

Many other passages might be adduced to shew that this assembly at Tara met for the celebration of a religious festival; and the conclusion, therefore, is unavoidable, that the word *Feis*, applied to this meeting in some of the lives of Patrick, if not an error of interpolators, was only used in a general sense, as applicable to a convention, feast, or festival of any kind. That this meeting, moreover, was the Druidical festival of *Bel-tinè* is apparent from the fact stated in all the lives of Patrick, respecting the prohibition to light a fire in the district until the sacred fire of the Druids had been first kindled at Tara; since, according to all the Irish histories, such a prohibition was always either issued or understood on the occasion of the lighting of the *Bel-tinè* in every district in the country. This prohibition is thus distinctly referred to in the original Irish of the Tripartite Life of St. Patrick, preserved in the *Leabhar Breac:*

Teit Pátraic iar sin co Fertaib fer Feicc. Adconnecar teinid occa ar in inuid sin i fercaib na Cerc. Fergnathach Loegaire oc chi in

Patrick goes afterwards to *Ferta fer Feic.* A fire was kindled by him at that place on Eastereve. Laeghaire is enraged as he sees the fire, for

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ceniu, ar ba hí[n] geir Temrach oc Goedelaib; ocus ní lamad nech ceniu oratéó i n-Eirinn iri[n] lou rin, no cu n-aosaidea hi Temraig ar cur iri[n] rolamain.

that was the privilege of Temur among the Gaël; and no one dared to kindle a fire in Ireland on that day until it should be first kindled at Temur at the solemnity.—*Leabhar Breac*, fol. 14, *a*, l.

The custom of the celebration of the *Bel-tinè* is thus distinctly recorded by Cormac Mac Cullenan in his Glossary, under the word *Belltaine*:

Belltaine .i. bil-cene .i. cene bil .i. cene roimmech .i. oa cene roimmech do ghnéir na oraíse co cuicetaib moraib roraib, ocus do berdir na ceeta ecura ar ceómanduib cecha bliadna.

Belltaine, i. e. *bil-tene*, i. e. the goodly fire, i. e. two goodly [lucky] fires, which the Druids were used to make, with great incantations on them, and they were used to bring the cattle between them, against the diseases of each year.

And thus in a MS. in Trinity College, Class H. 3. 18, p. 596:

Beltaine .i. Bel-oine: Bel, dan, ainm do idal: ir ann do eaurgeabtea oine cacha ceeta for feilb Beil; *unde* Beltene. No, Beltene .i. Bil-cine .i. cene croinneac .i. oa cenid do gnéir Druid co cuicetaib mora, ocus do legdir na ceeta ecarta ar ceomanduib cacha bliadna.

Beltaine, i. e. *Bel-dine*: *Bel* was the name of an idol: it was on it [i. e. the festival] that a couple of the young of every cattle were exhibited as in the possession of *Bèl*; *unde Beltine*. Or, *Beltine*, i. e. *Bil-tine*, i. e. the goodly fire, i. e. two goodly fires, which the Druids were used to make with great incantations, and they were used to drive the cattle between them against the diseases of each year.

It may, perhaps, be contended, against this conclusion, that the Druidical festival of *Bel-tinè* was, as it still is, celebrated on May-day, which is yet popularly called *Lá Bealltaine*, or the day of Baal's fire, and that it could not, therefore, be held on Holy Saturday, which at this period agreed with the vernal equinox. It has, however, been argued by Dr. O'Conor, with great ingenuity and plausibility, that the *Bel-tinè* of the pagan Irish was not the May-day of subsequent ages, and that the former, which was celebrated in the vernal equinox, and consequently fell about the 21st of March, was, after the establishment of Christianity, transferred to the 1st of May, to prevent an interference with the Christian Lent. To state and examine in detail the arguments of Dr. O'Conor in support of this conclusion, as given in the *Rerum Hibernicarum Scriptores*, vol. i., and in the Stowe Catalogue, would demand an inquiry inconsistent with the limits proposed in this memoir, but his theory may be briefly stated as follows:—I. That the year of the pagan Irish was luni-solar, consisting, like that of the Phœnicians and Egyptians, of 365 days

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and 6 hours. II. That it was divided by them, as it is among the moderns, into four *rathas*, or quarters. III. That these four *rathas*, or quarters, were called, as, with slight orthographical variation, the seasons are to this day by the modern Irish, *Samh-ratha*, Summer; *Foghmhar-ratha*, Autumn; *Geimh-ratha*, Winter; and *Iar-ratha*, (now *Earrach*,) Spring; the first of these quarters commencing at the vernal equinox, the second at the summer solstice, the third at the autumnal equinox, and the fourth at the winter solstice. IV. That at the beginning of each of these *rathas* a religious festival was celebrated, and that though the names of these festivals, as well as those of the *rathas*, are still retained, the periods at which they were celebrated were changed by the early Christians to agree with the Christian festivals, and so obliterate the recollection of the origin of the pagan rites, which they were not able utterly to abolish. Such is the theory of Dr. O'Conor; and among the various ingenious arguments which he advances in support of it, the strongest is that derived from the fact already alluded to, that the celebration of the Druidical fire at Tara in 433 occurred on Easter Eve. "All the writers of the life of S. Patrick," he states, "who wrote before the Anglo-Norman conquest, agree that S. Patrick celebrated his first Easter Eve in 433, that the fire which he had then lighted in his tent, near the hill of Temora, caused the greatest degree of curiosity as well as indignation, because it was an act so repugnant to the laws of the Kingdom, that he was conveyed as a criminal to the King, and that this gave occasion to his first preaching at Temora. Now Easter day in 433 agreed with the vernal equinox; therefore the *Baal-tinne* of the Irish concurred with that time of the year."—*Stowe Catalogue*, vol. i. pp. 32, 33.

While, however, the plausibility of this theory can scarcely be denied, without impugning the veracity of the facts given in all the ancient lives of St. Patrick, as to the period of the year at which he visited Tara, and the circumstances connected with it, on the other hand, it is but fair to state that the Doctor's arguments are throughout more ingenious than satisfactory, and that his references to authorities in support of his conclusions are such as, on examination, will seldom be found to bear him out in his assertions.

It does not appear from any of the Irish authorities that Oilioll Molt was ever converted to Christianity.

III. *Lughaidh*, the son of Laoghaire, succeeded Oilioll Molt, according to

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the Four Masters, in 479, or, according to the *Chronicon Scotorum*, in 480; but the more accurate Annals of Ulster place the beginning of his reign in 484, which would allow an interregnum of two years. O'Flaherty, without noticing this interregnum, places the commencement of his reign in 483. His death is recorded in the Annals of Ulster at 506, and again, from a different ancient authority, at 511, but it is correctly placed by Tighearnach in 508, with which O'Flaherty, in his corrected chronology, concurs.

From all the ancient historical accounts of the reign of this monarch, it appears certain that, like his predecessors, he died an obstinate unbeliever in the Christian religion; and there are many circumstances connected with the history of Christianity in Ireland during his reign, which have not hitherto received that attention from historians which they seem to merit. It has been already stated, at page 53, that the history of the propagation of the Gospel in Ireland, as collected by historians from the lives of St. Patrick and other documents, is involved in obscurities and contradictions, which the learning and judgment of the most critical investigators have been unable to penetrate and explain; and though the objects of, and limits assigned to the present memoir, will not allow of any elaborate attempt to elicit the truth as regards this most important and interesting feature in the history of the country, a few remarks may here be permitted, for the purpose of drawing the attention of future historians to facts not hitherto noticed in connexion with this subject.

That the acts attributed to one Patrick may be referable to, at least, two of the name, has been already hinted at in the passage just adverted to; and the probable correctness of this conjecture will derive support from the Irish records now to be adduced; and first, from the following historical notice of the reign of Lughaidh, as preserved in the Book of Leean:

Do gob thra Lugaid Mac Laegairi rigi n-Erenn ré coic bliadan, cor chuir techta d'iarraid na Boruma; ocus ni uair can chath; ocus ro thinóil uairli Leithi Cuinn do tobach na Boruma; ocus táncadur Laigniġ co Mag n-Ailbi. Do cuireḋ thra cath Muiġi Ailbi eturru, cor fraíneaḋ for Lugaiḋ, ocus for Muirchertach Mac Earca, ocus for Chairbri Mor Mac

Lughaidh, the son of Laeghaire, assumed th government of Ireland for five years; and he sent messengers to demand the Boru; and he did not receive it without a battle; and he assembled the nobles of *Leath Chuinn* to force the Boru, and the Lagenians came to *Magh Ailbhi*. The battle of *Magh Ailbhi* was fought between them, in which a victory was gained over Lughaidh and Muirchertach Mac Earca, and Cairbri Mor, the

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Neill; conad i n-igail [*recte* i n-oigail] in chachta sin nár fesair Muirchertach ocus Cairpri do Laignib cén fo bo beo iar. Airmit eolaig nár thabairg Lugaid in doroma acé aen echt co hurbadach.

Ir a n-aimsir Lugaich tainic Patraic i n-Erinn; ocus do chuaid co Temraig co airm a poibi Lugaid, ocus airgaid do churchneche cen ár, ocus birthlacé oc buaib fe a lind, ocus nem a forcend a faegail, ocus fon con, ocus egh, ocus sligi fair; ocus nir faem Lugaid fri, ocus ó nár aem do eargain Patraic hé, ocus ro eargain a rigan .i. Ailinn ingen Aengusa, Mic Nadfraich, rig Muman; conad o sin mall tea oimbuaid rigna for Themraig ocus cen buaid con or Temraig fór. Co fuair Lugaid Mac Laegairi bár i n-achad fairche ere ageume in Tailginn .i. fairche temmen do nim for marb iar n-diultad in Tailginn.

sen of Niall; and in revenge of this battle Muirchertach and Cairbri did not desist from [attacking] the Lagenians, as long as they lived. The learned state that Laghaidh never forced the Boru but once [and that] imperfectly.

It is in the time of Laghaidh that Patrick came to Ireland; and he went to Temur, where Laghaidh was, and offered him wheat without tillage, constant milk with kine during his time, and heaven at the end of his life, and success of hounds and horses, and of a queen upon him; and Laghaidh did not assent to that, and because he did not, Patrick cursed him, and also cursed his queen, i. e. Ailinn, the daughter of Aengus Mac Nadfraich, King of Munster; so that thenceforward there is an ill luck of queens on Temur, neither has it success of hounds. And Laghaidh, the son of Laeghaire, died at *Achadh Farcha*, in consequence of the curse of the *Tailginn* [saint], i. e. a flash of lightning struck him dead from heaven for having rejected the *Tailginn*.

It may be observed, that the preceding passage, which is quoted from an abstract of the history of Ireland from the time of the preaching of the Gospel, in the reign of Laoghaire, to that of Roderic O'Conor, is obviously taken from the ancient historians of the country, and that, at the period of its composition, whatever inducement might have existed for fabrication to sustain the received history of the Apostle Patrick's life, there could not have been any to controvert it. Indeed, that the compiler of this condensed history clearly understood that the Patrick alluded to in the preceding passage was different from another of the name, who preached the Gospel in the reign of Laoghaire, will appear manifest from the following notice relating to the reign of that monarch, in which the death of a *Senex Patricius* is recorded: "Do gob thra Laegaire Mac Neill Naoigiallaig rigi ericha *annis post adventum Patricii tenuit. Secundinus et senex Patricius in pace dormierunt*," i. e. Laoghaire, the son of Niall of the Nine Hostages, held the government thirty years after the arrival of Patrick. Secundinus and *old* Patrick slept in peace. As the passage last quoted has been extracted by O'Flaherty from the Book of Lecan, it is certain that he was

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not ignorant of the preceding one; and the conclusion is therefore unavoidable that he, as well as those other writers who were familiar with the Book of Lecan, must have intentionally suppressed it from a perception that it would contradict the received history of St. Patrick, as drawn up from his lives. The passage, however, is of great importance, as tending to indicate that the acts of, at least, two distinguished preachers of Christianity in Ireland may have been blended together, and thus furnishing a sufficient explanation of the apparent chronological and other contradictions in which the various lives of our saint abound, and which, in consequence, may be regarded as the result of an anxiety to ascribe the honour of the conversion of Ireland to a single individual. Should such a conclusion be ever established, the following passage in the Tripartite Life of St. Patrick, relative to the infidelity of King Lughaidh, and in which the displeasure of the Christian teacher is referred to the Patrick who preached in the reign of Laoghaire, might illustrate the manner in which the writers of the saint's lives constructed their legends for the purpose of transferring the acts of one saint to another:

"Factâ tantâ plagâ in populo, accedit vir Dei ipsum Regem, eique minatur scelerum suorum præsentem vindictam, subitamque mortem, nisi in Christum credat, desinatque veritati tot prodigiis probatæ ampliùs resistere. Loegarius timore et tremore perculsus, habitâ ad Proceres concione, concludit præstare sibi credere, quàm certam, præsentemque mortis subire sententiam. Rex igitur flexis genibus petit veniam, promittit emendationem, et se monita, et doctrinam viri Dei amplexurum. Ipse igitur, et hominum aliquot millia cum eo amplectuntur fidem Christi. Cùm autem vir sanctus videret Regem jam tandem superatum, et in alium hominem mutatum, ait ad ipsum; quandoquidem meis monitis tandem obtemperaveris, et paratus sis in propositâ veritatis viâ ambulare, nec sceptro nec vitâ privaberis; sed annis multis vives, et regnabis: quia tamen mihi et doctrinæ cælesti tam pertinaciter restitisti, et in via veritatis, tot signis monstratæ, ambulare recusasti, regni sceptrum de semine tuo in fratrum tuorum progeniem transferetur; tuaque posteritas eorum inserviet posteritati. Tunc Regina Angussa nomine, genua flectens humiliter virum Dei deprecatur, ut istius duræ sententiæ dignetur mitigare rigorem, et saltem ea non feriatur infans, quem ipsa tunc in utero gestabat. Annuit vir sanctus ejus petitioni, dicens; mea maledictio ei non nocebit, donec ipse propriis exigentibus demeritis mereatur maledici, et meæ maledictionis fulmine feriri. Et ita evenisse eventus evidenter monstravit. Nam Lugadius filius, qui tunc in utero matris gestabatur, regnum postea universæ Hiberniæ obtinuit, tenuitque usque dum quadam die iter agens, venit ad locum quendam *Achadh-farcha* appellatum; ubi cunspiciens quandam Ecclesiam in colle positam, ait; nunquid illa est Ecclesia istius clerici, qui iniquo prophetiæ spiritu, prædixit nullum de Leogarii patris mei semine Regem vel Principem prodituram? Et statim ac hæc protulit, fulminis è cælo missi, et in verticem ejus cadentis, ictu extinctus illicò interiit. Undè et locus nomen abinde sortitus, *Achadh-farcha*, i. e. collis fulminis appellatur."—Lib. 1. c. LXVII. *Trias Thaum.* p. 128, col. 1.

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However improbable the statement in the Book of Lecan may be, that the Irish Apostle did not come to Ireland before the time of Lughaidh, it is still not wholly impossible that it may be true; and, if it be, this legend must necessarily be regarded as a fiction invented to reconcile the account given of the opposition of Lughaidh to Patrick, with other legends in the lives of the saint manufactured at various subsequent periods. But, however this may be, the mere fact of the opposition, as stated in the Book of Lecan, would certainly seem to be borne out by the notice, taken literally, of the death of Lughaidh, in the authentic Annals of Tighearnach:

508. ẟaṙṙ Luġoach, mic Laeġaire, riġ Temrach in Achaṫ Fharcha .i. farcha ceneṫóe oo niṁ ro marb ian noiuleuṁ in Tailġinn.

A. D. 508. The death of Lughaidh, the son of Laeghaire, King of Temur, at Achadh Fharcha; i. e. a flash of lightning from heaven killed him after rejecting the Tailghinn.*

It is true that the account in the Book of Lecan of the coming of St. Patrick to Ireland in the reign of Lughaidh, cannot be reconciled with any of the other accounts preserved of the acts of the Irish apostle; but there is the less reason for suppressing any new fact bearing upon the subject, where the entire of the details given are in themselves so self-contradictory. Even the learned Dr. Lanigan appears to have succumbed to the difficulties that presented themselves in the consideration of this question, for though he has laboured with great ingenuity, and with even more professional zeal than he usually displays on other subjects, to place the life of Patrick on a solid foundation, he has not succeeded to such an extent as would satisfy a critical inquirer; and indeed the very line of argument which he has chosen has rather tended to involve the question in deeper obscurity.

As already stated, however, it is not intended in this memoir to enter fully upon an inquiry of such magnitude, but it may not be improper to state briefly the most striking difficulties which Dr. Lanigan has attempted to remove,—difficulties so great as to have even induced some learned men too hastily to deny the existence of St. Patrick altogether.

From the various authorities, as honestly published by Colgan, one would, at first sight, be inclined to believe, that instead of the one Patrick of Dr. Lanigan,

* For *Tailghinn*, in this passage, the Chronicon Scotorum has *Fodruig*, and it has been shewn at pp. 77 and 78, that *Tailghin*, which is translated *Aericiput*, in the Book of Armagh, *Archicapus* in the third life, *vir cum corona decorata* in the fourth life, *artis caput* in Probus, and *in circulo tonsus in capite* by Jocelin and Colgan, was a name given to Patrick by the Druids.

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there were five saints of that name, all of whom flourished in Ireland, and who were severally known by the names Palladius or Patricius, Sen-Patraic or Senex Patricius, Patrick the Apostle, Patrick junior, and Patrick *Aistire* or *Ostiarius*. The account furnished by Colgan is in these words:

"Præter S. Palladium, qui et ipse Patricius legitur appellatus, quatuor ad minus Patricii, qui sanctitatis laude in Hibernia floruerunt, à nostris Hagiographis recensentur. Primus fuit Magnus Patricius Hiberniæ Primas et Apostolus. Secundus, S. Patricius cognomento senior, Episcopus primò Ros-delanus in regione de *Magh-Lacha*, et posteà, vivente adhuc sancto Patricio Apostolo Episcopus Ardmachanus: qui colitur Glastoniæ in Britannia, et Ardmachiæ in Hibernia, ubi ejus reliquiæ asservatas et summo olim in honore habitas lego. Tertius, S. Patricius junior S. Patricii Apostoli discipulus, et ex fratre nepos. Et horum quidem singuli floruerunt sæculo quinto: nam primum obiisse anno 493, secundum verò anno 457, tradunt Quatuor Magistri in Annalibus ad eosdem annos: Tertius autem, et qui S. Patricii patrui sui jam defuncti acta conscripsit, vixit post annum 494. Et comparatione hujus dicti *Junioris* videtur præcedens Patricius *Senioris* cognomentum sortitus; vel fortè idcircò quod antè hunc et sanctum Patricium Magnum Hiberniæ Apostolorum è vita decessit. Quartus fuit Patricius Abbas aliàs Episcopus qui floruit sæculo nono," &c.—*Acta Sanct.* p. 366.

And again, in his Trias Thaum. p. 7, col. 1, note 22, he makes mention of another Patrick, a native of Auvergne, whose festival fell on the 16th of March.

Of these Patricks, the one called Palladius, and generally known by that name, may for the present be thrown out of the question, as he remained but one year in Ireland, and his era is too well known to admit of controversy. And in like manner the Patrick *Aistire*, may be dismissed, as he flourished in the ninth century. The inquiry will, therefore, have reference but to the remaining four; and of these four, three are thus distinctly alluded to in the following rhymes of an old monk of Glastonbury, quoted by Archbishop Ussher in his Primordia, p. 895.

"*Sunt hujus nominis, tene certissimè*
Tres Sancti Præsules: primus Hiberniæ
Archiepiscopus; alter Avernicæ,
Quâ natus fuerat ternus Hibernicæ.
Archiepiscopus primus Hiberniæ,
Is primus postea Abbas Glastoniæ,
Natus Britanniâ præclaro genere:
Ut sua Vita declarat optimè."

Of Patrick of Auvergne, here mentioned, however, so little is known, that the Bollandists and Lanigan have come to the conclusion that he was no other than the Apostle of Ireland himself; and even though he were a distinct person, it is obvious that he could have had no connexion with Ireland, as his bishop-

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rie existed in France. The entire number is thus diminished to three, and even of those three there is one,—the one already alluded to under the name of Patrick junior,—whose very existence is problematical. It is true indeed that Archbishop Ussher has, without including the Bishop of Auvergne, stated that there were three Patricks in Ireland, and it is upon his authority that Colgan has included the third Patrick, or Patrick junior, in his list; but for the existence of this Patrick there is at least no Irish authority whatever, or even any presumptive evidence beyond a mere surmise of Ussher, grounded on the following passage in Jocelin: "*Sanctus Patricius filiolus ejus, qui post decessum patrui sui Britanniam remeans in fata concessit, in Glasconensi Ecclesiâ sepultus honorificè.*"—*Primordia*, p. 817. Ussher, reading this passage, and knowing from various authorities, as well Irish as foreign, that a Patrick called *Sen* or *Senex*, and whom he supposed a different person from the Irish apostle, was interred at Glastonbury, at once adopted the notion that this Patrick mentioned by Jocelin must have been a third Patrick, and accordingly gave him the name of *Patricius junior*. The statement of Jocelin, however, as the Bollandists observe, can be entitled to very little attention. It manifestly proceeded from his desire to reconcile the vivid tradition existing in Glastonbury Church, with the adverse impressions of the Irish people; and as he wrote in the popular belief of his day, that the Apostle of Ireland was buried at Down, and knew, besides, that another Patrick was buried at Glastonbury, the expedient probably suggested itself to him of creating that nephew of the apostle, whom Ussher supposed to have been a separate Patrick. The Irish authorities are, however, at variance with Jocelin on this point, for they all agree that the saint who was buried at Glastonbury was Sen-Patrick. And in the list of homonymous saints preserved in the Books of Lecan and Ballymote, as well as in the ancient calendars, only three Patricks are mentioned, thus: "Ꝑatꝛaic Mac Calṗꝛuinn, Ꝑatꝛaic Ruiꝛꝛ ꝺela, Ꝑatꝛaic Aiꝛtiꝛe: *tres sunt.*" The Patrick last named died in the ninth century. Thus, then, three of the five Patricks may be considered either as non-existent or unconnected with the subject under discussion; and the question reduces itself to this: whether the acts of the remaining two have been confounded, and referred to one individual, or whether there was in reality, but one saint of the name.

That there were indeed two Patricks of great celebrity was the opinion of

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Archbishop Ussher, who endeavours to shew, from a great number of Irish and foreign authorities, that the first, or Sen-Patrick, was a bishop in Ireland, and died and was interred in the Abbey of Glastonbury, in Somersetshire, in 457; and that the second, the great Apostle, died in 493, and was interred at Downpatrick, in Ireland. On the other hand, according to Dr. Lanigan, the Sen-Patrick was the only Patrick, and his death and burial occurred at Downpatrick in the year 465.

It is probable that Ussher may be wrong in the supposition that Sen-Patrick was not the first Patrick who taught Christianity in the country, but it seems infinitely more probable that Lanigan is wrong in the conclusion which he has struggled so laboriously to maintain, that the Sen-Patrick was the only saint of the name. To establish this conclusion he is obliged to reject all the records in the Annals as well as foreign authorities, which place the death of Patrick in 493, and to assume that the true year of Patrick's death was either 458, 471, or, truly, as he maintains, 465, and that the story which makes him live 120 years is a mere fabrication to assimilate him with Moses. He is forced also to maintain that all the statements relative to the death and burial of St. Patrick at Glastonbury are monkish forgeries, and that the Patrick of Glastonbury was an abbot of the name, who retired there in the year 850, or some other Patrick, perhaps of the seventh or eighth century, who died on the 24th of August.

Had Dr. Lanigan, while he asserted that the Sen-Patrick of the authorities was the real Apostle of Ireland, acknowledged the existence of a second Patrick in the same age, to whom the title was erroneously given, it might be difficult to controvert his arguments; and many ancient authorities unknown to him could be adduced to strengthen his position: nor would it have been necessary, in placing the death of the Irish Apostle at any of the years recorded by the annalists as the date of Sen-Patrick's death, to have reduced the period of his life thirty years, in opposition to all the authorities, to accord with his assumed chronology, as those dates would sufficiently support him. Thus the Annals of Tighearnach place the birth of Patrick in 341:—"A. D. 341. *Patricius nunc natus est.*" And again, his captivity in 357, which identifies this Patrick with the author of the *Confessio*:—"A. D. 357. *Patricius captivus in Hiberniam ductus est.*"

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These dates, it will be at once obvious, would very nearly agree with the date of 457, as laid down in the Annals of Ulster, as the year of the death of Sen-Patrick, allowing one hundred and twenty years to his life; or, what is very remarkable, would agree exactly with the date 461, which is given in the same Annals from other authorities. Dr. O'Conor indeed objects to those dates in Tighearnach, that they are errors of the transcriber in copying the numerals; but he should have perceived that this was an unsatisfactory mode of accounting for the difficulty, as the entries in the Annals are ranged in strict chronological order, and the entry relative to the captivity of Patrick is made to synchronise with the mission of Julian the apostate into Gaul, and with the first year of the reign of Eochaidh Muighmheadhoin. There is, however, the most direct evidence to shew that this was not an error of the transcriber, but, on the contrary, is in accordance with the ancient records of the Irish, as appears from the following passage in the Tripartite Life of St. Patrick, formerly in the possession of Archbishop Ussher, and now in the Manuscript Library of Trinity College, Dublin:

"*Scoti de Hibernia sub rege suo Neill Naigiallach multùm diversas provincias Britanniæ contra Romanum imperium, regnante Constantio filio Constantini, devastabant: contendere incipientes Aquilonalem plagam Britanniæ. Et post tempus, bellis et clasibus Hibernienses expulerunt habitatores terræ illius; et habitaverunt ipsi ibi.* deinde, aliquibus interjectis. *Ductus est itaque sanctus Patricius ad Hiberniam captivus, primo anno regni Juliani imperatoris apostatæ, qui regnavit post Constantium; anno autem nono regni Neill Naigiallach regis Hiberniæ, qui* XXVII. *annis potenter regnavit; quique Britanniam et Angliam multùm devastavit, ibique in bello cecidit.*"—*Primordia*, p. 587.

In like manner the Annals of Connaught place the nativity of Patrick in 336, and refer his captivity to the year 352. "*S. Patricius in Hiberniam captivus ducitur anno Christi* CCCLII. *et post sex annos à captivate liberatur.*" And allowing one hundred and twenty years to his age, this would very nearly agree with the date of the death of Sen-Patriek in the same Annals, at the year 457: "*Anno* CCCCLVII. *dormitatio sancti Senis Patricii Episcopi Glosoniensis Ecclesiæ.*" And this is supported by the notice in Tirechan, already given at page 52, that the death of Patrick occurred two or five years before that of Laoghaire.

It may be objected indeed that the ninth year of the reign of Niall does not, according to Irish chronology, synchronise with the first year of the reign of

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Julian the apostate: but the annalists above quoted are more accurate in their chronology, and even if it were otherwise, in a question beset with so many difficulties, this could be but of small weight, the chronology of the kings of this period being technical, and evidently shaped into form at a comparatively modern age, as may be seen in the extract from the Book of Cuana, an authority of the seventh century, quoted from the Annals of Ulster, above, p. 81; and it may be observed that the Book of Clonmacnoise, as translated by Connell Mageoghegan, makes the reign of Niall Naoighiallach synchronise with the reign of Julian, as it places the reign of the former about the year 360. Any shade of doubt, however, that might exist on this point will be removed by the following decisive record, preserved both in the Annals of Tighearnach and Ulster, of which no notice has been hitherto taken, and from which it must be inferred that the date of 461, given in the Ulster Annals as the year of Patrick's death, has been copied from the Annals of Tighearnach, which are defective at that year: "A. D. 663. *In Campo Ito Focairt exarsit mortalitas primo in Hibernia, a morte Patricii* cc iii. *Prima mortalitas* c xii."—*Annal. Ult.* Tighearnach gives nearly the same words, but places the first appearance of this plague in 664, which is the true year, as has been demonstrated from a very remarkable eclipse by which, according to both annals, this plague was preceded in the same year.

Thus far the authorities adduced would seem to sustain Dr. Lanigan's hypothesis, that Sen-Patrick was the Apostle of Ireland; and the very epithet of *sen*, or old, prefixed to his name, would be a characteristic cognomen to one who, according to all the Irish accounts, had lived to so great an age. But this very appellation is in itself a strong evidence that there must have been another Patrick of later age, or who was not so remarkable for longevity, as the Irish have never applied the epithet *sen*, old, or *og*, young, to a man's name, except for the purpose of contradistinction either with regard to age or time. But if no other Patrick be allowed, these authorities would impugn altogether the dates assigned to the birth, captivity, and mission of the Apostle, as well as the time and place of his death. And hence Dr. Lanigan involves his theory in inextricable difficulties by denying the existence in Ireland of any other saint of the name, and is consequently forced to set himself in opposition to all the ancient authorities, which allow about one hundred and twenty years as the period of the duration of Patrick's life. He is, moreover, obliged to repudiate as

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monkish forgeries the authorities which state the death and burial of Sen-Patrick at Glastonbury, and the Irish authorities to the same fact as forgeries later and consequent on the former.

But these authorities are not to be destroyed so easily, for they are supported by evidences with which the Doctor was unacquainted, or which, at least, he has kept out of sight. Thus, when he asserts that the monks of Glastonbury forged the connexion of the Irish Apostle with Glastonbury out of an abbot Patrick, who died there in the ninth century, or some other (unheard of) Patrick, who died there in the seventh or eighth, he should have recollected that he had himself stated that the memory of Patrick was venerated there as the patron saint from the earliest times, as shewn by Ussher from the Charters of Baldred, Ina, and Eldred; and that the church of Glastonbury, when rebuilt by the Saxons, was dedicated to the Blessed Virgin and St. Patrick. And again, when he treats the scholiast of Fiech, who states the same fact as applicable to Sen-Patrick, as of no authority, he should have known and acknowledged that Colgan considered him an author of the seventh century, and that, at all events, his *scholia* are preserved in the *Liber Hymnorum*, which cannot be later than the ninth. But evidence to this fact is found in another work, the authority of which the Doctor has himself maintained, and which indeed it is impossible fairly to impugn, namely, the *Feilire*, or Festilogy of Aengus, written before the close of the ninth century. A copy of this work, as old as the tenth century, was in the possession of the late Edward O'Reilly, and there is another preserved in the *Leabhar Breac*, which is supposed to be of the twelfth century. The passage alluded to is given at the 24th of August, as follows:

lasreith sloig srenath
Flamma populi srenatii

ata sceoil ro clotha
Est fama quæ audita est

sen patraic cinn catha
Senex Patricius caput prœlii

coem aite ar srotha.*
Mitis præceptor nostri patroni.

* In explanation of *Srenatii* the Glossographist of Aengus says, ".i. i n-Gloinestir na n-Gaedel i Saxanaib .i. in Britannia;" that is, in *Gloinestir* of the Gaël, in England, i. e. in *Britannia*

On this point, indeed, the Martyrology of Tamlacht, compiled in the ninth century, that of Cashel, compiled in the eleventh, and all the later Martyrologies concur, as thus stated by Colgan, who had them all in his possession:

"Colitur Patricius Senior die 24. Augusti (qui ab Hibernis primus mensis Authumni vocatur) ut tradunt S. Ængussius, Marianus, Mart. Tamlactense, Calendarium Casselense et Maguir ad eundem diem, qui dicunt quod Ros-delæ in Mag-lacha tractu Ossoriæ in Hibernia: et addunt Calendarium Casselense, Scholiastes Mariani, et Maguir quod verius sit quod *Patricius Senior sepultus Glastenberiæ Hibernorum* (hoc est Glastoniæ ubi multi olim erant sancti Hiberni) *in Australi parte Britanniæ*: et quod Reliquiæ ipsius asserventur Armachæ: et addit Maguir quod fuerit Doctor sive Magister nostri Apostoli Patricii."—*Trias Thaum.* p. 7, col. 1.

But if any doubt existed that the Irish and English both considered the saint of Glastonbury as the Sen-Patrick of the Irish, it would be removed by the two following passages, quoted by Ussher, one from the Annals of Connaught, and the other from the Life of St. Dunstan, the author of which, as he states, lived in the time of that distinguished man:

"Ejus obitum in Annalibus Connaciensibus ita consignatum invenimus. *Anno* CCCCLIIII. *dormitatio sancti Senis Patricii Episcopi Glosonienis Ecclesiæ.* quod de *Glastoniensi* Ecclesiâ ut accipiamus, verba illa antiquissimi Vitæ Dunstani scriptoris suadere videantur. *Hibernensium peregrini prædictum locum Glestoniæ, sicut et cæteræ fidelium turbæ, magno colebant affectu; et maximè ob beati* PATRICII SENIORIS *honorem, qui faustus ibidem in Domino quievisse narratur.*"—*Primordia*, p. 895.

And again, the same learned investigator, in treating of the first occupation of Glastonbury by the Saxons, adduces the following authorities to shew the connection of Patrick with that monastery:

"Sed Glastonienses CCL. ante Dunstanum annis, primum Anglicæ gentis abbatem sibi præfuisse

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And in explanation of coem aice ap proéa, he writes between the lines, "Aice Parpaic Macha, *Sancti Patricii Episcopi doctor.*" And in the margin of the MS. is written the following note:—"Sen Parpaic o Rup bela a Mui3 locha: *sed verius est* comad i n-Slaiteinzibepna na nGaedel i n-Deiciuiz Saxan aeai; *Scoti enim prius in peregrinatione ibi habitabant.* Cée a eaei a eheipi i n-Ulaid. Sen Parpaic i n-Apomacha." i. e. old Patrick of Ros-dela in Magh Locha; but it is more true that he is (i. e. is interred) in Glastonbury of the Gaël, in the South of England, for the Scoti were dwelling there on a pilgrimage. But his reliques are in Ulster. Old Patrick at Armagh. In Cormac's Glossary, under the word Mo3e1ne, Glastonbury is also called Glaistimbir of the Irish. "Slaiteinbir na n-Gaedel .i. Cell mor for bru mara n-Ice." Glaistimbir of the Gaël, a large church on the margin of the Ictian Sea.

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tradunt Beorwaldum vel Brithwaldum: primum verò simpliciter *B. Patricium* nostrum; de quo, in Additionibus ad Guil. Malmesburiensis librum de cœnobii illius antiquitate, ita legimus. *Certissimum est, S. Patricium Hiberniensium Apostolum apud nos requiescere, et nostri Monasterii primum Abbatem fuisse, tam ex scripturis antiquis, quàm etiam ex ejusdem sancti Chartâ.* Et pòst. *Glastoniam veniens anno Domini* CCCCXLIX. *duodecim fratres anachoriticè viventes ibidem reperiens congregavit: Abbatisque omnium voluntate et electione, licèt invitus suscipiens officium, eosdem vitam agere docuit cœnobialem. Per hunc enim religio Monachorum in Glastoniâ sumpsit exordium; vitam ducentium monachorum more Ægyptiorum. Nondum enim exortum erat sidus aureum, scilicèt pater Benedictus, quod orbem terræ suâ doctrinâ et exemplo foret illustraturum.* Et in ipso Malmesburiensis libello. *His diebus mortuo Vortigerno, regnabat supra Britones Aurelius Ambrosius: et Saxones invalescebant, et multiplicati sunt valde. Sanctus verò Patricius Hiberniensium Apostolus, et in insulâ Avallonie Abbas primus, postquàm prædictos fratres regularibus disciplinis convenienter informaverat, et eundem locum terris et possessionibus de dono Regum ac aliorum principum competenter ditaverat; post annos* XXXIX. *ab adventu suo in insulam Avallonie decursos, naturæ cessit.* Illi *S. Benignum* successisse affirmat ibidem Guilielmus: ac deinde addit. *Successerunt ibidem plures de natione Britonum abbates; quorum tam nomina quàm gesta et memoriam oblivionis nubilo obducens delevit antiquitas. Ipsam tamen Ecclesiam apud magnates Britonum in maximâ fuisse veneratione, ostendunt eorum exuviæ ibidem requiescentes.* Item: *Effluxis à tempore S. Patricii annis* CCLXVII. *regnante post Kynegilsum filio suo Kenwalco, qui et Cenwalli est dictus, primus de Anglis præsedit in Glastoniâ abbas Britwaldus.*"—*Primordia*, pp. 109, 110.

Thus, then, it might perhaps be assumed with as much certainty as a question of such extreme difficulty could permit, that the Sen-Patrick of the Irish, and the *Patricius senior*, of Glastonbury, were one and the same, and that Dr. Lanigan was not justified in his conclusions that the notices respecting him, however blended with fable, were modern forgeries and of no authority; and hence it would follow as a necessary consequence, that if this Patrick be, as Dr. Lanigan states, the real apostle of the Irish, the facts relative to the place and year of his death, and more particularly the 24th of August, the day of his death, on which the authorities all concur, must also be received as facts equally proved. But hence would arise a new question of greater difficulty than the preceding; for, if Dr. Lanigan be correct in his conclusion that there was no other saint of the name in Ireland, contemporaneous, or nearly so, with Sen-Patrick, it would naturally be asked,—Are all the authorities, Irish as well as

* "MS. libell. de reliquiis cœnobii Glaston. circa temp. R. Henrici III. script. Johan. Tinmuthensis in Vitâ Patricii. Tabula magna Glastoniens. &c.

† "MS. in Bibliothecâ Collegii S. Trinitatis, Cantabrig."

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foreign, which place the death of the Irish Apostle in Ireland, on Wednesday, the 17th of March, in 491, 492, or 493, to be abandoned as groundless forgeries? If so, the whole history of the propagation of Christianity in Ireland would be thrown into utter confusion, and it would be difficult to place confidence in any thing written on the subject. On the other hand, should the existence of a second Patrick, subsequent to the former, be allowed, it would also necessarily follow that much, if not nearly all that has been written respecting his life, more properly belongs to the former Patrick, and has been fraudulently given to the second for the purpose of investing him with the honor of the apostleship of Ireland. It is not, however, as already stated, the object of this memoir to establish any conclusion, but to furnish such facts as may be of use to others who may apply their minds to this interesting subject; and, as the evidences have been given in favour of the former conclusion, it will be proper also to add an analysis of the authorities on which the latter rests.

Assuming then that there was a second Patrick in Ireland in the fifth century, and that many of the acts of the former have been falsely ascribed to him, it may be stated that the Irish as well as foreign authorities nearly concur in the following facts:

1. That he was born in the year 372.

2. That he was brought captive into Ireland in the sixteenth year of his age, in 388, and that after four or seven years' slavery he was liberated in 392 or 395.

3. That on the death of Palladius, in 432, he was sent to Ireland as archbishop, having been first, according to some authorities, consecrated by Pope Celestine, or, as others state, in Gaul, by the archbishop Amatorex or Amator.

4. That he arrived in Ireland in 432, and, after preaching there for sixty years, died in the year 492 or 493, at the age of about 120 years.

5. That he was interred either at Saul or Down.

Of these facts the following summary is found in the *Leabhar Breac*, (fol. 99, *b.* 1,) the oldest and best Irish MS. relating to church history now preserved, or which perhaps the Irish ever possessed:

Debemus scire quo tempore Patricius Sanctus Episcopus atque præceptor maximus Scotorum inchoavit venire ad Hiberniam,

We ought to know at what time Patrick, the holy bishop, and chief preceptor of the Scoti, began to come to Ireland to preach and baptize, and

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prædicare, et baptizare, et mortuos suscitare, et sanare omnes morbos, et effugere omnes dæmones de Hibernia, et sanctificare et consecrare, et ordinare et benedicere, et docere et consummare, [*recte* consummare,] *quia Apostolus ait, Certamen bonum certavi et cursum consummavi, &c.*

Da hi ꝺ̇a blιaꝺain ceτhe Paτραιc oo ċum n-Ḟρeno, Nin. ιṙin ṁeṙṙ blιaꝺain ꝛ̇ccc. ap ecc. o Incholluġuo, ιṙin noṁaꝺ blιaꝺain flaiṫeaṁ Teoτhaiṁeṙ, ṙíġ in ꝺomain, ocuṙ ιṙin ceiṫiṁ blιaꝺain Ḟḟιṫcoṙꝺoi Xιṙi, comoṙba Paτraiṙ, ocuṙ ṙ in ceiṫṙeaṁaꝺ blιaꝺain flaiṫeaṁ Loeġaiṙe Mic Neill ; Temaiṙ, ocuṙ ιṙin *Lx.* aṫaṁaꝺ blιaꝺain a aiṙe ṗoꝺein. *Lx.* blιaꝺain aṙa, oo ic baiṫeaꝺ ocuṙ oo ṙoiṙceeul ṙeṙ n-Ḟρeno, aṁail aṙ beṙe Fiaċc :

Ḟṙiṫeaċaiṙ eṙi ṙiċhee blιaꝺnaiḃ
Cṙoċhi Cṙiṙe oo chuaṫaiḃ Ḟeṙne, &c.

Is he in ṙo ṙa ṫeiṫeuṙ h-Eleṙáiṁ ṙoṙ Paṫraiṙe, in ṫan ṫucaiḋ táiṙe Paṫraiṙe chuca oo Cluain h-Iṙaiṙo:

Ḋa miṅ, ba máṙ Mac Calṗuṙṅ,
Cṙoeḃ ġíne ṙo meṙṙ,

to resuscitate the dead, and to cure all diseases, and to banish all the demons from Ireland, and to sanctify and consecrate, and to ordain and bless, and to contest and consummate; for the Apostle says, I have fought a good fight, and I have finished my course, &c.[a]

The year, then, Patrick came to Ireland was in the thirty-third year above four hundred from the Incarnation,[1] in the ninth year of the reign of Theothanes,[2] [*recte* Theodosius,] king of the world, and in the first year of the Episcopacy of Sixtus,[3] the coarb [successor] of Peter, and in the fourth year of the reign of Loeghaire,[4] the son of Niall, at Temur; and in the sixtieth year of his own age.[5] He was sixty years baptizing and instructing the men of Ireland, as Fiec says:[6]

He preached for three score years
The crucifixion of Christ to the tribes of the *Feni*.[7]

Here is the character given by Heleran[8] of Patrick, when he brought them an account of him to Clonard:

Meek and great was the son of Calphurn,
A vine branch under fruit, [i. e. bearing fruit]

[a] II. Tim. iv. 7.

[1] 433, i. e. reckoning from the conception, not the birth of Christ.

[2] Counting from the death of Honorius, in the year 423, the ninth year of the reign of Theodosius would be 432, which is the year in which, according to all authorities, St. Patrick came to Ireland.

[3] That is, in the first year of Pope Sixtus III., who succeeded Celestine on the 10th of August, 432.

[4] King Laoghaire succeeded, according to the Four Masters, in the year 429; 432 would consequently be his fourth year.

[5] According to this chronology Patrick was born in the year 372, which is also the date given in the Chronicle of Florence of Worcester, but this is thirty-one years later than the period assigned to his birth by Tigbearnach, and thirty-six later than that given in the Annals of Connaught.

[6] This would fix Patrick's death in the year 492, or, reckoning from the period of the Conception, as some of the Irish annalists do, in 493.

[7] By *Feni* Fiec certainly means the people of Ireland, who, according to all the Shanachies, were called *Feni*, *Gaii*, and *Scoti*, from three of their celebrated progenitors. See Fiec's *Scholiast*, *Trias Thaum.* p. 7.

[8] Eleran, generally called *Elerannus Sapiens*, is supposed by Colgan to be the author of the fourth Life of Saint Patrick published in *Trias Thaum.* He died a very old man in 664, according to the Four Masters, Ware, L. 1, c. 13, and Usher in his Chronological Index. This quotation from Eleran is also given in the Litany of Aengus.

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Nir boi náo cairt aée * *
Co pirro a lerr.
Seche coecat ranee fruehperrcop
Ro hoprone in cáo,
Imm eri cee cruimcher n-óg
Forrra forrmarg grado.
Tri cee argerech ro rcrib,
Du bil lid a kim'.
Seche cee cell cain conicaib, [conéagaib]
Dor nócaib do lar.

He never expended * *
Until it should be required.
Seven times fifty saintly senior bishops
This saint ordained,
With three hundred pure priests,
On whom he bestowed dignity.
Three hundred alphabets he wrote,
Good was the coloring of his hand.
Seven hundred holy churches he left,
Which he raised from the ground.

Re forbanurcuir eria Parrarc a rith m-buicci trin *xx.*amao bliadain for ceo a aire .i. i mbliadain tri. *xx.* r. *Kl.* Enair for Aine, ocur cec bliadain for birex.a, hi *xvi.* imurro *Kl.*ne April na bliadna rin for Cérain, ocur *xiii.* ruirri. Ir ann do rala éreche Parrarc Mic Alpuirn .i. trin oechmad bliadain flaicha Laigoach Mic Loegaire, ocur trin nomad bliadain déc abbacine Cormaic, Comorba Parrarc; ocur ir e rin ceetna abb do écio i cathair Parrarc; ocur ir i rherr bliadain flaicha Echach, Mic Aengura, rig Caiprl, ocur flaicha Fiachna Luirg, Mic Coelbaid, rig Dal n-Araide, ocur flaicha Maine, Mic

Patrick finished his victorious course in the one hundred and twentieth year of his age,[9] that is, on the 27th year [of the solar cycle] the Calends of January on Friday, the first year after the bissextile, on the 16th of the Calends of April, which in that year fell on Wednesday, the 13th [of the moon].[10] The death of Patrick, the son of Alphurn, [*recte* Calphurn,] occurred in the tenth year of the reign of Lughaidh,[11] the son of Loeghaire, and in the ninth year of the abbacy of Cormac, Coarb of Patrick,[12] the first abbot who went in Patrick's chair, and in the third year of the reign of Eochaidh, the son of Aengus, King of Cashel,[13] and of the reign of Fiachna Lonn, son of Coelbadh, King of *Dalaradia*,[14] and of the reign of Maine,

[9] This agrees with the calculation that he was sixty years old when he arrived in Ireland in 432, and that he preached for sixty years more.

[10] According to Sir W. R. Hamilton, all these astronomical definitives agree with the year 493, except 27 for the solar cycle, which, to agree with the Calends of January on Friday, should be 26. The error probably originated with the transcriber. See *Lanigan*, vol. i. p. 131, and *Usher*, *Primordia*, p. 882. The *Book of Ballymote* states that Patrick was born, baptized, and died on Wednesdays—"Tri ceetaine Patraic, a gein, a baitsiu, a bar."

[11] According to the Annals of Ulster, which reckon the year of Christ from his conception, not his birth, Lughaidh succeeded Ollioll Molt in 484, but correctly, according to O'Flaherty, in 483. Consequently the tenth year of Lughaidh would be the four hundred and ninety-third from the birth of Christ.

[12] Cormac is called *Bishop* of Armagh, and the *heir*, i. e. coarb or successor of Patrick, in the Annals of Ulster, in which his death is recorded at the year 496. He is called Episcopus and Coarb of Patrick by Tighearnach, who places his death in 497. He succeeded Iarlaith, who died, according to the Annals of Ulster, in 481, which, as Dr. O'Conor proves, should be 483, and therefore the ninth year of his abbacy (or episcopacy) would be 492.

[13] According to the Annals of Tighearnach Aengus Mac Nadfraich was killed in 490. The third year of the reign of his son and immediate successor would, therefore, be 493.

[14] Not recorded by Tighearnach. He is, however, mentioned by the Four Masters as King of Dalaradia, at the year 478.

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Cerbaill, rig Uisnig, ocus Domangoirt, Mic Fergusa, rig Alban, ocus Fraech, Mic Finochuda, rig Laigen, ocus Duach Tenga-huma, rig Connacht, ocus Muirchertaig, Mic Erca, rig Ailig, ocus Coirill, Mic Muiredaig Munderg, rig Ulad. Iteat sin robtar frecnairce etsecht Patraic amail at fiadat liubair ocus eolaig.

Tri bliadna xxx. din, ó bas Patraic co bas m-Brigte isin lxx.mad bliadain a haíse. In oen bliadain tra, bás Brigte ocus in cetna Ailill abb Aird Macha. Se bliadna xxx. o bás Brigte co cath Cúile Dremni. Coic bliadna xxx. o cath Cula Dremni co bás Coluim Cilli .i. isin lxxvi. a aíse. Teora bliadna xl. o bás Coluim Cilli co cath Muige rath. V. bliadna xx. o cath Muige rath cos in m-Buide Chonaill, dia n-erbailt

son of Cerbhall, King of *Uisneach*,[15] and of Domangort, son of Fergus, King of Scotland,[16] and of Fraech, son of Finnchadh, King of Leinster,[17] and of Duach Tenga-Uma, King of Connaught,[18] and of Muirchertach Mac Erc, King of Aileach,[19] and of Coirell, son of Muiredhach Muinderg, King of Ulidia.[20] These were present at the death of Patrick, as books and learned men testify.[21]

Thirty-three years from the death of Patrick to the death of Bridget in the seventieth year of her age.[22] In the same year occurred the death of Bridget and that of Ailill I. Abbot of Armagh.[23] Thirty-six years from the death of Bridget to the battle of *Cuil Dremni*.[24] Thirty-five years from the battle of *Cuil Dremni* to the death of Columbkille in the seventy-sixth year of his age.[25] Forty-three years from the death of Columbkille to the battle of Moira.[26] Twenty-five years from the

[15] Not noticed by Tighearnach. The death of Maine Mac Cearbhaill is recorded in the Annals of the Four Masters, at the year 531, but by the Annals of Ulster at 537.

[16] Domangart, King of Scotland, succeeded, according to Pinkerton, from the best authorities, in 506, and ruled four years. It is, therefore, a mistake to synchronise the period of Patrick's death with any year of this king's reign.

[17] Fraech, the son of Fincha, was killed, according to Tighearnach, in 495.

[18] Duach Teanga Uma, King of Connaught, succeeded in 480, and was killed, according to Tighearnach, in 500.

[19] Muirchertach Mac Erca, the Hector of the northern Scoti, became King of Aileach in 48, was elevated to the throne of Ireland, according to Tighearnach, in 509, and died in 534.

[20] Cairell, the son of Muireadhach Muinderg, is mentioned by Tighearnach at the year 508, as King of Uladh or Ulidia. His father died, according to the Annals of the Four Masters, in 479; and his own death is recorded in the same Annals at the year 526.

[21] The literal meaning of frecnairce is present, either with respect to time or locality, and it must be here understood in the former sense, as it is hardly possible that all these kings could have been personally present at Patrick's death.

[22] "Dormitatio Sanctæ Brigidæ LXXXVIII. ætatis suæ, vel LXX tantum, ut alii dicunt."—*Tighearnach.* "Obiit Brigida anno ætat. 70, anno XXX post mortem Patricii, æræ C. 523."—*Dr. O'Conor, Ann. Tig.* p. 130, n. 28. "Omnes, uno ore, referunt obitum S. Brigidæ ad ann. XXX post excessum S. Patricii."—*Dr. O'Conor, Annal. Ult.* p. 11, note 3.

[23] The Annals of Ulster place the death of St. Bridget under the years 523 and 525, at the latter of which they record the death of Aillii, Bishop of Armagh. Dr. O'Conor argues that 523 is the true year. This is an additional proof that 493 is the year intended by the writer for the death of Patrick.

[24] This would place the battle of *Cuil Dreimni* in the year 559, which seems the correct year. The Annals of Ulster record this battle first at the year 559, and again, from a different authority, at 560, which is also the year given by Tighearnach.

[25] This would place the death of Columbkille in the year 594, which is the date given in the Annals of Ulster. "594. Quies Col. Cil. v Idus Junii, an. etatis sue lxxvi."

[26] This would place the battle of *Maghratha* in 637, which is the year given by Tighearnach.

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Diarmaic ocus Blathmac, da mac Aeda Slaine. *V.* bliadna *xx.* ón Buide Chonaill co rus maith Finachta, Mac Moliduin, mic Aeda Slaine in Borime do Moling. Teora bliadna *xxx.* o rus maith in Borime co cath Almaine i torchair Fergal, mac Moliduin. Se bliadna *x.* o chath Almaine co cath Uchbuid. *Xl.* bliadain o chath Uchbaid co bas Neill Frassaig, Mic Fergaile. *V.* bliadna *l.* o bas Neill Frassaig co hec Concobair, Mic Donochada ocus Artri, comorbai Patraic.

* * * Ocus din, is in aimsir sin do chotar buaid martra .i. Cipriainus ocus Cornilius. Fiche bliadain tra, o'n *vii.*mad ingreim co gabail Erend do Chormac h-Ua Cuind, is in tres bliadain slatha *Probi Imperatoris.* *V.* bliadna *xx.* iar sin in nomad ingreim *sub*

battle of Moira to the *Buidhe Chonaill*,[27] [a plague,] of which died Dermot and Blathmac, two sons of Aodh Slaine.[28] Twenty-five years from the *Buidhe Chonaill* until Finachta, the son of Moelduin, the son of Aedh Slaine, remitted the *Boru* to Moling.[29] Thirty-three years since the *Boru* was remitted to the battle of *Almhain*, in which Fergal, the son of Moelduin, was slain.[30] Sixteen years from the battle of *Almhain* to the battle of *Uchbadh*.[31] Forty years from the battle of *Uchbadh* to the death of Niall Frassach, son of Fergal.[32] Fifty-five years from the death of Niall Frassach to the death of Conchobhar, the son of Donnchadh,[33] and of Artri, coarb of Patrick.

* * * * At this period[34] Cyprianus and Cornelius[35] received the victory of martyrdom. Twenty years from the seventh persecution[36] until Cormac Ua Cuinn assumed the government of Ireland, in the third year of the reign of Probus the Emperor.[37] Twenty-five years after that the

[27] This would place the first appearance of the *Buidhe Chonaill* in the year 662, which is one year earlier than the date given in the Annals of Ulster. This dreadful plague, which raged all over Europe, was preceded by an eclipse, which the Annals of Tighearnach and Ulster record to the hour. Dr. O'Conor proves that the true year was 664, which is the date given by Tighearnach.

[28] They died in 465, according to the Annals of Tighearnach.

[29] Finachta abdicated, and became a clergyman, in 687, according to the Annals of Ulster, which agrees with the year of his remission of the Boru to Moling, the great patron saint of Leinster.

[30] This would place the battle of Almhain in the year 720, which is one year earlier than the date given in the Annals of Ulster, and two years earlier than the year given by Tighearnach.

[31] This would place the battle of Uchbadh in the year 736, which is too early by a year or two. The Annals of Ulster place this dreadful battle in 737, and Tighearnach in 738, which Dr. O'Conor proves to be the true date.

[32] That is, in the year 776, one year earlier than the date in the Annals of Ulster.

[33] That is, according to this calculation, in 831, which is one year earlier than that in the Annals of Ulster. "A. D. 832, Artri Mac Concobhair, Abbot of Armagh, and Concobar Mac Donnchadh, King of Tara, died in the same month."

[34] There is something omitted here in the original, as is obvious from the context. After carrying on the chronology from the period of St. Patrick to the death of Artri, Archbishop of Armagh, the writer here commences in a very abrupt manner a second series of foreign chronology, from the period of Cyprian, the martyr, down to the mission of Palladius and Patrick to Ireland.

[35] St. Cornelius was martyred in 252, St. Cyprian in 258.

[36] The seventh persecution was commenced in the beginning of 250.

[37] Probus, the emperor, succeeded in 276, and died in 282. This would fix the first year of the reign of Cormac Ua Cuinn in the year 279; and from the commencement of the seventh persecution to the third year of the reign of Probus would be twenty-nine, not twenty years.

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Diocletiano principe. Seche m-bliadna iar
sin cetheorpaic Senaid Hece .i. viii. n-apo-
epreoip x. ar ccc. isin dail sin. Tricha bli-
adam iar sin co hetheche Anneoin mamaig.
Seche mbliadna x. iar sin co bar helair
Epreoip Piczeuc. Vii. m-bliadna iar sin
co eetheche n-Ambroip. Noi mbliadna
x. iar sin co eetheche Martain. Da bliadain
iar sin co gabail Epreoporoi do Augurtin
in hipone in-Affraic. V. bliadna xx. iar
sin co bár Augurtin. Dech m-bliadna o
bar Augurtin co ro roiscd *Palladius a Papa
Celestino* co rorcéla iair do Paetraic dia
proicepe do Scotaib. Ir ri imo sin in oen-
maid bliadain ar cccc. o chroich Chirt; madh
o thóir domain, ic da bliadain xxx. ar
ccccc. ar v. mile. Ir in bliadain iar sin do
sechu Paetraic do proicepe do cum n-Erenn.
Equus et Valerianus da immpir na bliadna
sin. Ir in bliadain sin por [xab] Xirtr am-
chinoeche Roma i n-degaid Caelestine. Ir hi
sin iiii. bliadain flaithi Loegaire Mic Neill
i Temair. Da hertroe in eter rig x. ro

ninth persecution under the Emperor Diocletian.[39] Seven years after that the assembling of the Synod of Nice,[40] at which three hundred and eighteen archbishops were present. Thirty years after that to the death of Anthony the monk.[41] Seventeen years from that to the death of Hilary,[42] Bishop of Pictavia. Seven years from that to the death of Ambrose.[43] Nineteen years from that to the death of Martin.[44] Two years from that until Augustin assumed the bishopric of Hyppo[45] in Africa. Twenty-five years from that to the death of Augustin.[46] Ten years[47] from the death of Augustin until Palladius was sent by Pope Celestine, with a gospel for Patrick, to preach it to the Scots. This was the four hundred and first[48] year from the crucifixion of Christ; and if we reckon from the beginning of the world, five thousand six hundred and thirty-two years. In the year after this[49] Patrick went to preach to Ireland. Equus [*recte* Aetius] and Valerianus [*recte* Valerius] were the two emperors [*recte* consuls] of that year. It was in this year Sixtus assumed the [ecclesiastical] supremacy of Rome after Celestine. This was the fourth year

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[39] Diocletian was elected emperor in 283, twenty-four, not twenty-five years from the third year of Probus.

[40] The Council of Nice was held in 325, forty-two, not seventeen years after the commencement of the reign of Diocletian.

[41] St. Anthony died in 356; that is, thirty-one, not thirty years after the convention of the Council of Nice.

[42] St. Hilary, Bishop of Poitiers, became bishop in 355, and died in 372, sixteen years after the death of St. Anthony.

[43] St. Ambrose died in 397, twenty-five, not seven years after the death of St. Hilary.

[44] The death of St. Martin is referred to the year 397 by Gregory of Tours, and by Sigebertus to the year 402, but Dr. O'Conor attempts to prove that 401 is the true date. No authority places his death nineteen years after the death of St. Ambrose, as stated here.

[45] St. Augustin became Bishop of Hyppo in 396, before the death of St. Martin, and not twenty-one years after it, according to this chronology.

[46] St. Augustin died in 430, thirty-four, not twenty-five years after his appointment to the Bishopric of Hyppo.

[47] This, if not an error of the transcriber in writing *dech* for *da*, is entirely wrong; for, according to Prosper, Palladius was sent to Ireland in 431.

[48] The four hundred and first year from the crucifixion of Christ would be the year 434.

[49] According to this calculation Patrick would have come to Ireland in 435, but as his coming is synchronised with the consulship of Aetius and Valerius, and with the first year of Pope Sixtus, the year intended is certainly 432, and the error must have originated with the transcribers.

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ꝼaḷḷuṙcaiṙ Cṁe hó aimṙiṙ na c. ṙiġ n-auṙ. ḃeṙc ṙo ṙanoṙac Cṁe ecuṙṙu hi coic .i. Conċoḃaṙ, Aillil, Coiṙṙṙe, Eochu, Cuṙi. Ala bliaḋain aṙ cccc. iaṙ ṙin hó epoich Cṙiṙe ; ocuṙ eṙeṙ bliaḋain *xxx.* aṙ ccccc. aṙ v. míle o ċhúṙ ḋomain.

Fin-ic, Amen.

of the reign of Loeghaire, son of Niall, at Temur. He was the thirteenth king, who governed Ireland since the period of the five famous kings, who divided Ireland between them into five parts, viz.: Conchobhar, Aillil, Coirpre, Eochu, [and] Curi. This was the four hundred and second year from the crucifixion of Christ, and the three and thirtieth year above six hundred and five thousand from the beginning of the world.

Finit, Amen.

The age of the preceding document, which has not been hitherto published, or even noticed, may be ascertained with tolerable accuracy from a catalogue of the successors of St. Patrick, in the see of Armagh, which immediately follows it in the same MS. and which is constructed on the same scheme of chronology, and appears to be the composition of the same writer. The last archbishop named in this catalogue, and in whose time it was obviously drawn up, is Domhnall, the son of Amhalghaidh, who succeeded in 1091 or 1092, and died in 1105; and as the writer allows only eight years to his episcopacy, it is clear that he wrote about the year 1100. That the chronology of these documents was drawn up in accordance with, as well as to sustain the popular belief of the period respecting the important eras of the saint's life, is sufficiently obvious; and it may, therefore, be regarded as the best existing authority in support of the system which it was intended to uphold. That its chronology is almost entirely erroneous in whatever precedes the assumed period of Patrick's mission, has been shewn in the preceding notes, as well as its general accuracy from that period forward. The inaccuracies in the former are, however, of small importance in this inquiry, as the only question to be investigated is, whether the dates usually assigned to Patrick's birth, mission, &c., can be sustained by historical evidences or not, and to this inquiry the subject now naturally turns.

1. With respect to the period of Patrick's birth, it may be briefly stated that Ussher assigns it to the year 372, and Colgan to 373. For either of these dates, however, no record has been found in the Irish Annals, and it rests solely on the authority of the Chronicle of Florence of Worcester, compiled in the twelfth century. The Bollandists assign his birth, conjecturally, to the year 377, and Dr. Lanigan thinks he settles the point by placing it ten years later, and this solely on

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a conjecture of Tillemont's, founded on certain passages in the *Confessio* of St. Patrick, which passages, even if authentic, would be indeed a very uncertain guide, but which are in reality not found in the oldest and purest copy of that work extant, namely, that preserved in the Book of Armagh, which is stated to have been transcribed from the original, written by the Saint's own hand.—See *Lanigan*, vol. i. pp. 135, 136. As already stated, the only notices on this point found in the Irish authorities refer it to 333, or, as Tighearnach has it, 341.

2. With respect to the date of his captivity, a few words will also suffice. Ussher, in accordance with the statement of the fact in the *Confessio*, that he was sixteen years old at the time, assigns it to 388, to agree with the assumed year of his birth; and Lanigan, in like manner, to suit his theory, places it in 403. The assumption of Dr. Lanigan is, however, of no weight, as the conclusion on which he founds it has been already shewn to be groundless; and in this, as in the former case, the Irish Annals of Tighearnach, which assign his captivity to the year 357, are opposed to the conjectural dates of both.

3. The year of his mission. This is the point on which the whole question as to the existence of a second Patrick hinges, and, as stated by Ussher, is that on which nearly all the authorities concur:—"In mortis anno designando, ut vides, magna est inter istos discrepantia: de anno missionis in Hiberniam nulla."—*Primordia*, p. 880. It might be supposed, therefore, that this point was beyond the reach of controversy, and yet unfortunately it is that on which many learned men have since felt the greatest degree of doubt; nor has any sufficient evidence been found that would set this important question at rest. The foreign authorities for the fact reach no higher than the eleventh century, when, it might be argued, the Irish legends of his life had been worked up and dispersed over Europe, through the innumerable missionaries which Ireland had sent out. The authorities in the Irish Annals on this subject are of uncertain antiquity, and their notices of this, as well as the circumstances connected with it, seem to have been wholly derived from the popular lives of the saint. It is to be regretted that on this important point the authority of the ancient Bodleian MS. of Tighearnach is wanting, as the portion of it relating to the period is lost; but there can be little if any doubt that the passages wanting in that copy are preserved in the more modern copies of his Annals in Dublin, called the *Chronicum Scotorum*, which record the mission of Patrick at 432, but omit that

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of Palladius. The Annals of Ulster do, however, record both, and give their authorities in a passage, the importance of which has not hitherto been sufficiently appreciated.

"An. ab incarnatione Domini cccexxxi. Palladius ad Scotos a Celestino urbis Rome Episcopo, ordinatur Episcopus, Aetio et Valeriano Coss; primus mittitur in Hiberniam, ut Christum credere potuissent, anno Theodosii viii.

"An. cccexxxii. Patricius pervenit ad Hiberniam ix anno Theodosii junioris, primo anno Episcopatus Xisti xlii Episcopi Rom. Eccl. Sic enumerant Beda et Marcellinus, et Isidorus, in chronicis suis."

Here then are references made to authorities, which, if correct, should at once settle the question; but, unfortunately, no passages relating to Patrick's mission are found in any printed edition or MS. copy of the works of the writers referred to, while the mission of Palladius is recorded in them all. Indeed the silence of Bede, as well as the earlier chroniclers, has long been felt as a negative argument, not easily refuted, against the mission of Patrick. But, however fatal this silence, particularly of Bede, may be to the mission of a Patrick following Palladius, in order of time, it should not be considered as an objection to the existence of a preacher of the name in Ireland anterior to that period; and indeed the ancient churches and other monumental remains connected with his name, found in all parts of Ireland, as well as the vivid traditions still universally current, are sufficient to satisfy any candid inquirer, that such a personage must have existed, whatever may have been the period at which he flourished.

Another objection which has been made to the truth of these accounts is, that, whether Palladius died, as the Bollandists state, on the 6th of July, 431 or 432, or the 24th of January, 432, as Lanigan argues from other authorities, there would still be too little time between that and the period of the death of Celestine, on the 6th of April that year, for the account of that event to have reached Rome, or at all events, for Patrick to have travelled thither to be consecrated and commissioned by him; and Lanigan acknowledges that Patrick could not have heard of the death of Palladius until about the latter end of February, or beginning of March. Dr. Lanigan, therefore, is obliged to reject the fact stated in some of the lives respecting Patrick's visit to Rome and consecration there by Pope Celestine, after the death of Palladius; and he endeavours to meet the difficulty by the supposition, which he thinks satisfactory, but for which there is no authority, that St. Patrick was ordained second in the mission,

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though not consecrated bishop, at the same time with Palladius, and that consequently on the death of the latter he proceeded no farther than Gaul to receive the Episcopal dignity, and was accordingly consecrated there by a bishop, Amathus, Amatorex, or Amator. But this again involves a new difficulty, as this Amatorex, according to the Scholiast of Fiach, and several of the lives, was Bishop of Auxerre; and, as the only bishop of that name had died fourteen years before, it is manifest that he could not have consecrated Patrick a bishop at the period assigned. To meet this objection, Dr. Lanigan, while he acknowledges that no other Gallican prelate of the name is found in the history of the times, offers another equally improbable conjecture, namely, that his consecrator was a Bishop Amandus of Bordeaux, and that the name Amandus might have been easily changed into *Amatus*, *Amathæus*, or *Amator*. But with those who may be disposed to consider the true era of Patrick as earlier than that usually assigned to him, this conjecture will have but little weight, and the statement respecting Amatorex of Auxerre will carry evidence in favour of the truth of their hypothesis.

From the preceding observations it will be evident that the authorities hitherto quoted are insufficient to establish the mission of a second Patrick, if the claim of Palladius to the name be allowed. It remains then to inquire how far the *Confessio* and the lives in the Book of Armagh sustain this assumed fact.

And, first, of the *Confessio*, it may be briefly stated, that this interesting document, which the learned generally have considered genuine, does not, in that most ancient and uninterpolated copy preserved in the Book of Armagh, contain even a single passage which would throw the slightest light on the obscurities of the question. It might, in fact, be equally applicable to any earlier Patrick as to the reputed one of this period.

The collections in the Book of Armagh, relating to the Life of Patrick, are supposed, apparently with justice, to have been written in the seventh century, and their authority must therefore be taken in preference to that of all the later lives, which are evidently but systematized amplifications of them. Yet it will be seen that even in those documents the statements are so vague and contradictory that nothing very conclusive can be gleaned from them. The first of these lives, which, in a ruder style, is nearly the same in substance as that published by Colgan under the name of Probus, is ascribed by Ussher to Maccuthenius, a writer of the seventh century. In this life no statement of the consecration or

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mission of Patrick by Pope Celestine is found. It mentions, however, somewhat ambiguously, that Patrick, while with St. Germanus, desiring to proceed to Ireland, the latter sent an old priest called *Segitius* with him as a companion and witness; and, that Patrick hearing in Ebmoria, a city of Gaul, of the death of Palladius, applied to a neighbouring bishop, Amathorex, to receive the episcopal dignity, after having obtained which he proceeded to Ireland.

"Oportuno ergo tempore imperante comitante divino auxilio coeptum ingreditur iter ad opus in quod olim præparatus fuerat utique avanguelii, et missit Germanus seniorem cum illo, hoc est Segitium prespiterum ut testem comitem haberet, quia nec adhuc a sancto domino Germano in pontificali gradu ordinatus est.

"Certe enim erat quod Paladius Archidiaconus Papæ Caelestini Urbis Romæ Episcopi, qui tunc tenebat sedem apostolicam quadragensimus quintus a Sancto Petro Apostolo, ille Palladius ordinatus et missus fuerat ad hanc insolam sub brumali rigore possitam convertendam; sed prohibuit illum [Deus convertere gentem illam—Probus], quia nemo potest accipere quicquam de terra nisi datum ei fuerit de cælo. Nam neque bii fieri et inmites homines facile reciperunt doctrinam ejus, neque et ipse voluit transegere tempus in terra non sua, sed reversus ad eum qui missit illum revertere vero eo hinc et primo mari transito, coeptoque terrarum itenere in Britonum finibus vita factus [*recte* functus].

"Audita itaque morte Sancti Paladii in Britannis, quia discipuli Paladii, id est Augustinus et Benedictus et cæteri redeuntes retulerant in Ebmoria de morte ejus; Patricius et qui cum eo erant declinaverunt iter ad quendam mirabilem hominem sumnum æpiscopum Amathorege [*recte* Amathoregem] nomine in propinquo loco habitantem, ibique Sanctus Patricius sciens quæ eventura essent, ibi episcopalem gradum ab Mathorege sancto episcopo accepit, etiam Auxilius, Iserninusque, et cæteri inferioris gradus eodem die quo sanctus Patricius ordinati sunt.

"Tum acceptis benedictionibus, perfectis omnibus secundum morem, —— venerabilis viator paratam navim in nomine Sanctæ Trinitatis ascendit et pervenit Brittannias. Et omissis omnibus ambulandi anfractibus præter communæ viæ officium, nemo enim diasidia quærit Dominum, cum omni velocitate, flatuque prospero mare nostrum contendit."—Fol. 2, p. *a*, col. 1 & 2.

In the amplifications of the above obscure and apparently defective passage, as given in the Tripartite and other later lives, it is stated that Patrick was sent by Germanus to Rome to receive the approbation of the Pope to his mission, and to be consecrated for the purpose. But that Maccuthenius did not intend to convey any thing like this appears clear from the headings of the chapters prefixed to his work to be noticed presently, and in which it is distinctly stated, that going to the apostolic see, where he wished to learn wisdom, he met with St. Germanus in Gaul, and *therefore went no farther*. This is also shewn from the interpolated version of his life by Probus, which, however, sends Patrick to

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Rome to receive the apostolic blessing, after having preached unsuccessfully in Ireland many years *before* the mission of Palladius.

The next notice bearing on the question is found in the following passage appended to this life, called the *Dicta* of St. Patrick: but in this passage, which is very obscure, it is merely stated that the saint travelled through Gaul, Italy, and the islands in the Terrhene Sea. It appears, however, to be the groundwork of the amplified details to this effect, found in the later lives.

"Timorem Dei habui ducem iteneris mei per Gallias atque Italiam, etiam in insolis quæ sunt in mari Terreno. De sæculo requisistis ad Paradissum *Deo gratias;* aeclessia Scotorum immo Romanorum, ut Christiani, ita ut Romani sitis, ut decantetur vobiscum oportet omni hora orationis vox illa laudabilis *Curie lession, Christe lession,* omnis æclessia quæ sequitur me cantet *Cyrie lession, Christe lession, Deo gratias.*"—Fol. 9, p. *a*, col. 1.

The next document in the collection is the annotations of Tirechan, which, as the transcriber states, were taken "from the mouth or book of Ultan," who was the first bishop of the *Dal-Conchubair*, at Ardbraccan, and flourished in the beginning of the seventh century. In this tract, which is a collection of traditional notices, not a regular life of the Apostle, the mission of Patrick, after the death of Palladius, is thus distinctly recorded:

"Xiii anno Teothosii Imperatoris a Celestino Episcopo, Papa Romæ, Patricius Episcopus ad doctrinam Scottorum mittitur; qui Celestinus xlv episcopus a Petro Apostolo in Urbe Roma.

"Paladius Episcopus primo mittitur, qui Patricius alio nomine appellabatur; qui martyrium passus est apud Scottos ut tradunt Sancti antiqui. Deinde Patricius secundus ab anguelo Dei, Victor nomine, et a Celestino Papa mittitur; cui Hibernia tota credidit; qui eam pene totam babtizavit."—Fol. 16, p. *a*, col. 1.

The next tract is the preface addressed by Maccuthenius, the author of the first life in this volume, as already noticed, to Aidus, Bishop of Sletty, for whom it was written; and this is followed by a table of the heads of the chapters contained in the first book. This preface and table have been placed out of their proper order, through the ignorance of the transcriber, who was a different scribe from the person who copied the life itself; and hence Ussher, who had this book in his possession, says on one occasion,—*Primordia*, p. 818,—that the Life of Patrick, by Maccuthenius, contained only the heads of chapters; and yet, subsequently seeing his error, although it did not occur to him to state it, he several times refers to the life itself as the work of this author, and on one occasion, p. 832, gives a long extract from it. This apparent inconsistency did not escape the observation

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of Colgan, though he was not able to account for it.—See *Trias Thaum.* p. 218, col. 1. That this preface and table of contents belong to, and should have been prefixed to the first book of the work of Maccuthenius, is satisfactorily proved by their perfect agreement with the matter contained in it, and by the fact that a similar table is prefixed to the second book, and which is in its proper place.

The settlement of this point is of considerable importance, as it determines, beyond a doubt, the age of the life itself. And as the preface clearly shews that, even at the period of the composition of this work, which is undoubtedly the foundation of all the subsequent lives, as well as the notices in Erric of Auxerre and Nennius, the greatest uncertainty existed respecting the history of Patrick, and as the writer acknowledges that his authorities were doubtful, and their truth suspected by many, it necessarily follows, not only that the details of subsequent writers on the points under consideration, not contained in this life, must have but little claim to historical authenticity, but also that even the statements of Maccuthenius himself, must be received with considerable caution.

The preface alluded to runs as follows:

"Quoniam quidem, mi Domine Aido, multi conati sunt ordinare narrationem utique istam secundum quod patres eorum, et qui ministri ab initio fuerunt sermonis, tradiderunt illis; sed propter difficillimum narrationis opus, diversasque opiniones, et plurimorum plurimas suspiciones, numquam ad unum, certumque historiæ tramitem pervenierunt: ideo, ni fallor, juxta hoc nostrorum proverbium, ut deducuntur pueri in ambiteathrum, in hoc periculossum et profundum narrationis sanctæ pylagus, turgentibus proterve gurgitum aggeribus inter acutissimos Carubdes per ignota aequora insitos, a nullis adhuc lintribus, excepto tantum uno patris mei cognito, si expertum atque occupatum ingeni olim ei puerilem remi cymbam deduxi. Sed ne magnum de parvo videar finguere, pauca hæc de multis Sancti Patricii gestis parva peritia, incertis auctoribus, memoria labili, attrito sensu, vili sermone, sed affectu pissimo, caritatis et sanctitatis tuæ et auctoritatis imperio oboedens, carptim, gravatimque explicare aggrediar."—Fol. 20, p. *a*, col. 1.

After the table of contents the following notice is appended:—"Hæc pauca de Sancti Patricii peritia et virtutibus *Muirchu Maccumachtheni*, dictante Aiduo Slebtiensis civitatis Episcopo conscripsit."—Fol. 20, *b*, 1.

It is greatly to be regretted that the first folio of this life has been lost since the book was in the possession of Archbishop Ussher, but the subjects of which it treated are preserved by Probus, though, as usual, in an amplified or interpolated form, as appears from the titles of the chapters given in the table already referred to. These titles, however, throw but little light on the subject now

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under consideration; but, though they seem to shew that the writer believed that Patrick never went to Rome, they concur with the other lives in referring the date of his consecration to a period subsequent to the death of Palladius. The titles of the lost chapters, as well as those relating to his mission, are here given: (Fol. 20, *a*, 1.)

"De ortu Patricii et ejus prima captivitate.
De navigio ejus cum gentibus et vexatione diserti cibo sibi gentilibus divinitus delato.
De secunda captura quam senis decies diebus ab inimicis præstulerat.
De susceptione sua a parentibus ubi agnoverunt eum.
De ætate ejus quando iens videre sedem apostolicam voluit discere sapientiam.
De inventione Sancti Germani in Galliis et ideo non exivit ultra.
De aetate ejus quando visitavit eum angelus ut veniret adhuc.
De reversione ejus de Gallis et ordinatione Palladii et mox morte ejus.
De ordinatione ejus ab Amathorege Episcopo, defuncto Palladio.
De rege gentili habeto in Temoria quando venerat Sanctus Patricius babtismum portans."

The remaining tract is called the Book of the Angel. It relates chiefly to the rights due to the See of Armagh; and contains nothing which throws any light on the subject under consideration. It is, in fact, a mere fabrication to support the authority of the church of Armagh; and indeed it is not easy to avoid a suspicion that all the lives in this Book of Armagh have been written with a view to serve the same purpose.

On the whole, then, it will be seen that these are the most ancient lives of the saint now extant, and the originals from which all the more amplified lives published by Colgan have been derived; and the conclusion therefore follows, that the mission of a Patrick in 432 rests on authorities as early as the seventh century. Still it must be confessed that these authorities are so uncertain and contradictory, and, as Maccuthenius acknowledges, derived from such doubtful, and even then suspected sources, that it is difficult to refrain from a suspicion that this Patrick may be no other than the Palladius of the Roman authorities, and that the particulars of his life may have been drawn up from materials as properly belonging to the biography of the Sen-Patrick of the Irish authorities as to his own. The probability of the truth of this conjecture will be increased by an investigation of the authorities which treat of the time of his death and place of his burial, to be next noticed.

4. The year of his death. On this point the authorities are all at variance.

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The dates in the oldest documents,—the lives in the Book of Armagh,—appear to agree with those to which the death of Sen-Patrick is referred by the annalists. The life by Maccuthenius is, indeed, silent on this head, but, as it states that the saint was one hundred and twenty years of age when he died, and as a similar statement is made in the life by Tirechan, in which the death of Patrick is placed two or five years before the death of Laoghaire,—that is, according to the chronology of the Irish Annals, in 458 or 461,—it may be concluded that both biographers concur on this point; and it is remarkable that Giraldus Cambrensis also places the death of Patrick the Apostle in 458. It has, however, been already shewn that these are the dates assigned by the Irish annalists to the death of the first or Sen-Patrick; and that these dates must refer to him is obvious, as, if they belonged to the Patrick who came in 432, it would contradict the statement in all the lives, that he was sixty years preaching in Ireland.

But the Irish annalists, as well as a crowd of foreign writers, place the death of Patrick, the Archbishop and Apostle of the Irish, in 491, 492, or 493. Thus the entry in Tighearnach, which has been copied by most of the subsequent annalists, quotes an ancient Irish quatrain as authority for the date 493:

"A. D. 493. *Patricius Archiepiscopus et Apostolus Hibernensium anno etatis sue centesimo vigesimo, xvi. Kal. April. quievit.*

"O ȝenemain Cpiſt, ceim aiꞇ,	From the birth of Christ, a pleasant period,
Ceꞇ̇pe ceo ꝼop caem noċaiꞇ	Four hundred above fair ninety,
Ꞇeopa bliaȯain ſaep iap ſein	Three noble years after that
Co baſ Paoraiꞇ pꞃim Apſtail."	To the death of Patrick, chief Apostle.

This quatrain is also quoted by the Four Masters, and in all the copies of the *Chronicon Scotorum* preserved in Dublin, and most correctly in Duald Mac Firbis's copy of that work, preserved in the MS. Library of Trinity College, Dublin, which is here given with Colgan's translation, *Trias Thaum.* p. 234:

"O ȝenap Cpíſt,—áipeaṁ aiꞇ,	A nato Christo (calculando rectè),
Ceꞇ̇pe céaꞇ ꝼop caoṁnoċaiꞇ	Quadringenti cum nonaginta,
Ꞇeopa bliaȯna beaċꞇ iap ſin	Et tribus annis insuper,
Ȝo báſ Paoraiȝ pꞃiom Apſpail.	Usque ad mortem Patricii, præcipui Apostoli nostri."

And thus, if this passage be not an interpolation, which is not very probable, it would appear that Tighearnach understood this Patrick, the Archbishop and Apostle, as a different person from an earlier Patrick, whose birth, captivity, and death he had before recorded. But still the accuracy of this date will be apt to

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be doubted by the impartial investigator, when it is considered that it is not found in the original lives of the Saint, and a suspicion can hardly fail to arise that it owes its origin to the necessity for reconciling the sixty years assigned to the Saint's mission in Ireland with the year 432, in which it is asserted to have commenced. As to the foreign authorities, they can have little weight in this question as the most ancient of them, that of Florence of Worcester, is not earlier than the beginning of the twelfth century.

Another point connected with this question is the reputed day of his death; and on this the authorities, ancient as well as modern, all concur in the statement, that it was the 17th of March. Thus in the earliest, the Book of Armagh:

"——— Quod in die xvi Kal. Aprilis peractis totius ejus vitæ annis .cxx. et provenerat sicut omnibus totius Hyberniæ annis celebratur."—*Maccuthenius.*

"Sollempnitate dormitationis ejus honorari [debet] in medio veris per .iii. dies et .iii. noctes omni bono cibo præter carnem quasi Patricius veniisset in vita in hostium."—*Tirechan.*

So also in the *Feilire* or *Festilogium* of Aengus, at the 17th of March:

LASAIR GRENI AINE,
Flamma solis puri,
ASPOL EREND OIGE,
Apostolus Hiberniæ sacræ,
PATRAIC COMET MILE
Patricius custos millium
ROP DITIU DIAR TROIGE.
Fuit præsidium nostris miseris.

Here then is a perfect agreement of all the authorities, ancient as well as modern, as to the day at present universally received as the festival of the Irish Apostle; and this day is altogether different from that assigned to the death of Sen-Patrick, as well as different from any one of the days, for there are several, assigned as that of the death of Palladius. But though these records seem clearly to establish the fact that a second Patrick, the reputed Apostle, died on the 17th of March, the very great degree of uncertainty respecting the day as well as year of the death of Palladius, leave it by no means clear that this may not as properly be his day. The day of Palladius's death is variously assigned to the 15th and 25th of December, 431, and to the 27th of January and 6th of July, 432; and where three of these dates must obviously be wrong, it is not unreasonable to conclude

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that the fourth may be wrong also. But, however this may be, it is obvious, that without rejecting the most ancient historical evidences, the existence of a second Patrick cannot be questioned, whether this Patrick was Palladius or not; and if he were not Palladius, it will be difficult, if not wholly impossible, to collect any authentic circumstances relative to his history. It is indeed impossible to come to any other conclusion on this head without rejecting as fabrications all the historical dates of the annalists and the authority of Aengus and Fiech's Scholiast, relative to the elder Patrick; but this rejection would be wholly unwarrantable, for though there might have been a motive to fabricate authorities in support of the history of the second Patrick, after it had been shaped into something like form, it is obvious that there could have been none to induce those writers to do so in opposition to that history, and thus contradict even their own statements. Dr. Lanigan, who, on this question, rejects the best authorities when they war with his hypothesis, and admits the worst when they support it, finding that the dates assigned by the annalists to the death of Sen-Patrick, whom he wished to make identical with the apostle, would not agree with the tradition of the Irish that the latter died on a Wednesday, assigns the death of Patrick to the year 465, and this solely on the authority of the Annals of Innisfallen, and because he found that the 17th of March in that year fell on Wednesday, as well as in 493. But he should have acknowledged that the Annals of Innisfallen, with respect to their chronology, are weak authority indeed in comparison with the more ancient annals, and particularly when they are not corroborated by other documents; and even if the fact were otherwise, the passage in question could not be received as an authentic record, because it bears the evidence of an error in the transcription, as can be clearly shewn. The passage is as follows;—"*An.* cccclxxxviii. Kl. *Quies Patricii in* xvi Kl. *April. Anno* ccccxxxii. *a passione Domini. Quies Meic Cuilind Luscai.*" Thus it appears that the year intended was 488, and that the death of Mac Cuilinn, Bishop of Lusk, is placed in the same year with that of Patrick. But Mac Cuilinn died, according to the Annals of Tighearnach and Ulster, in 495; and as all the events in the Annals of Innisfallen at this period are a few years antedated, it is obvious that an error has been committed in the numerals, from which Dr. Lanigan's conclusion was drawn.

5. The place of his interment. It will have been recollected that the Irish, as well as the Glastonbury authorities, concur in the statement that Sen-Patrick,

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or Senex Patricius, was interred at Glastonbury; but according to the lives, Patrick the Apostle was buried at Saul or Downpatrick. On this point, however, the accounts are so legendary and contradictory, that, if any conclusion could be drawn, it would be that they are all fabulous, and that nothing was known on the subject. This is acknowledged by Tirechan, who writes that where his bones are no one knew:—"*ubi sunt ossa ejus nemo novit.*" It is true, that he afterwards states that his place of burial was pointed out at Saul-Patrick by St. Columbkille, through the inspiration of the Holy Spirit:

"Colomb cille Spiritu Sancto instigante ostendit sepulturam Patricii, ubi est confirmat, id est in *Sabul* Patricii, id est in aeclesia juxta mare, ubi est conductio martirum, id est ossium Coluimb cille de Brittannia, et conductio omnium Sanctorum Hiberniæ in die judicii."—Fol. 15, *b*, & 16, *a*.

But this legend was evidently fabricated after the death of Columbkille, for the purpose of giving to Saul the honor of having the sepulchre of both.

The life by Maccuthenius has a more ridiculous legend to account for his interment at *Dun-leth-glaisse*. It states that the saint, feeling his end approaching, commanded himself to be carried to Armagh, but was prevented by an angel, who desired him to return to Saul; and that afterwards the same angel advised him as to his burial, and directed that after his death two untamed oxen should be suffered to proceed wherever they wished, and that where they should rest a church should be founded in honour of his body, which was accomplished accordingly, the Son of God guiding them to *Dun-leth-glaisse*, where Patrick was buried. These legends require no comment; and it is pitiable to find such a man as Dr. Lanigan endeavouring to account for the uncertainty on this point apparent in the lives, by the supposition that the *exact* spot of his grave only was meant. But, according to Maccuthenius, the exact spot was known, for he says that in after times, when the church was in progress of building over his body, the men who were digging the ground perceived fire to break out from the grave, and retiring, they fled with fear from the flame. It is enough to state that on this point the ancient annals are silent, with the exception of the Annals of Ulster, in which is transcribed from the Life of Columbkille, the legend that narrates that saint's discovery of the sepulchre of Patrick, but without naming the locality.

From the preceding data, then, it will be apparent:

1. That the Irish authorities clearly prove the existence of at least two teachers

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of Christianity in Ireland popularly called Patrick, namely, Sen-Patrick, and Patrick the Archbishop; and, that the attempts of Dr. Lanigan to shape a consistent life of the Irish Apostle, by making him identical with the Sen-Patrick of the Irish and Glastonbury authorities, can only be sustained by an unwarrantable rejection of the most ancient records bearing on the subject, and by substituting in their place conjectures either wholly gratuitous, or, at best, founded on documents of inferior credit.

2. That the most ancient Irish annals appear to make a distinction between the first Patrick and the second, the one being called St. Patrick, or Sen-Patrick, and the second Patricius Archiepiscopus et Apostolus, an epithet which is obviously applicable to the Patrick of Celestine; and that while the death of the latter is placed in the year 492 or 493, the death of the first Patrick is placed by the same annalists in 458 or 461.

3. That the acts of these two Patricks have been so blended together by the biographers—if they may be so called—of the supposed apostle's life, that it is now impossible to separate them, or to determine, with any degree of certainty, the acts which properly belong to either; though this much may perhaps be gathered, that the first, or Sen-Patrick, appears to have preceded the mission of Palladius; that he was the author of the *Confessio*, and the Irish Hymn, which last is now first published in this memoir, if these productions be not spurious; and, that he died about the year 461, and was interred at Glastonbury, whither he had retired, as it would appear, previously to the mission of the second Patrick.

4. That the acts of the second Patrick are so feebly supported by ancient historical evidences with respect to dates, time and place of birth, death, and burial, and every thing except his mission, as to lead to the suspicion that even on this point there may have been a fabrication, and that he may have been no other than the Palladius of the Roman authorities, whose life is involved in an equal degree of mystery.

In support of this perhaps novel conjecture many facts from the ancient lives and other authorities might be adduced, of which a few will suffice:

1. That the oldest Irish authorities shew that Palladius was also called Patrick.

2. That the Roman authorities, as well as Bede, while they record the mission of Palladius, are wholly silent respecting Patrick.

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3. That Prosper ascribes the same success to the mission of Palladius that the Irish do to that of Patrick.

4. That in the various copies of the Annals of Tighearnach, known by the name of the *Chronicon Scotorum*, and which supply the chasms in the Bodleian copy of those annals, no mention is made of the mission of Palladius, but of that of Patrick only.

5. That in the different versions or copies of the Saxon Chronicle, as remarked by Ussher, where the mission of Palladius is recorded, no mention is made of that of Patrick, and that where that of Patrick is given that of Palladius is omitted, and that the dates are the same in all, and the words the same, excepting in the names, whether referring to the one or the other.

An. ccccxxx. Heꝛ paꝛ Palladiuꝛ a ꝛend ꝛꝑam Celeꝛtine þam Papan to bodiande Scottum ꝛullpiht.—*Cod. Cot.*

An. ccccxxx. Heꝛ paꝛ Patꝛiciuꝛ a ꝛend ꝛꝑam Celeꝛtine thæ Papan to bodnianne Scottum ꝛulluht.—*Cod. Petroburg. et Laud.*

6. That in the extract given in the preceding sheet from the *Leabhar Breac* Palladius is stated to have brought with him from Rome a copy of the Gospel for St. Patrick, a circumstance which would hardly be explicable if the Irish Apostle succeeded him.

7. That Sen-Patrick is stated, in the oldest authorities, to have been the master or instructor of the patron of Ireland, and in the life by Probus it is stated that the latter was ordained priest by a St. Senior.

8. That Palladius, according to an ancient authority quoted by Ussher, was, like Patrick, a Briton.

9. That Patrick and Palladius, according to the lives, landed at the same harbour in Wicklow, and were opposed by the same chief.

10. That Palladius and Patrick are stated to have brought the same relics of the Apostles from Rome, though, according to Maccuthenius, St. Patrick never proceeded farther than Gaul.

11. That Palladius, according to Prosper, was the instigator of the mission of Germanus to Britain to root out the Pelagian heresy, while, according to the lives, Patrick accompanied Germanus to Britain for the same purpose.

12. That Palladius is said to have been unsuccessful in his mission, and that he left Ireland to return to Rome; and the oldest of the lives published by

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Colgan, that by Probus, states that Patrick also was unsuccessful, and revisited Rome to obtain the apostolic benediction, but that he afterwards returned to Ireland.

13. Lastly, it may be repeated, that nothing certain is known of the year in which either this second Patrick or Palladius died, or the place where they were interred, which could hardly have been the case if Patrick died in Ireland, nor could the relics of Sen-Patrick *only* have been venerated at Armagh, as it is stated they were, if those of the second Patrick could have been obtained.

These coincidences are thrown out for the consideration of the learned, with a hope that they may assist in promoting a spirit of impartial investigation of this interesting portion of the history of Ireland; and though the subject has led to a much more extensive apparent digression from the immediate object of this memoir than was anticipated, or was desirable, still it cannot be considered as out of place in a dissertation on the history of a spot in which the first great effort is said to have been made to establish Christianity in the country, by the conversion of its monarch and chieftains. But, even if it were otherwise, it is hoped that an effort to assist in the elucidation of a subject so interesting in itself, and so important as that on which the whole chronology of Irish history has been erected, by the publication, in a faithful and ungarbled manner, of ancient documents, bearing upon the subject, and hitherto locked up from the learned, may be received in a spirit of indulgence.

To resume the list of kings:

IV. *Muircheartach Mac Earca* succeeded Lughaidh, according to Tigh-earnach, in the year 509, but, according to the Annals of Ulster, with which Ware and O'Flaherty agree, in 513, there having been, according to the latter annals, an interregnum of five years' duration.

The following notice of the reign of this prince is given in the Book of Lecan, fol. 306, p. *a.* col. 1:

Do ꝫob ꝛꝑa Muiꝛcheꝛꝛach (.i. Mac Eꝛca) Mac Muiꝛeꝛaich, mic Eoꝫan, mic Nell Naiꝫiallaich, ꝑiꝫi n.Eꝛenn ꝑé ceaꝛhꝛa bliaꝺan ꝑichet.

Iꝛ aiꝛi ꝺeꝛꝛhea Mac Eꝛca ꝑe Muiꝛcheꝛꝛach .i. ꝑeꝛc ꝛhucaꝛꝛaiꝛ Eꝛꝛoc Eꝛc Slanꝫa ꝺo, ꝺia ꝺoeḃꝛaꝺ ꝛo:

Muirchertach, (i. e. Mac Erca,) son of Muredhach, son of Eogan, son of Niall of the Nine Hostages, assumed the government of Ireland for a period of twenty-four years.

Muirchertach was called Mac Erca, because Erc, Bishop of Slane, placed his affection upon him; of whom was said:

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Ερροc Ερc, ———
Cecé ni con cerpoio ra cepc.
Cach aen berer co cepc cáip
Fopfbaio bennache Ερροιc Ερc.

Bishop Erc, ———
Whatever he adjusted was right.
Whoever judges justly and fairly
Will receive the blessing of Bishop Érc.*

No, ip í Ερc, ingen Coupn, a mathair, ocup ip aipi a oepchea Mac Ερca de.

Or, Earc, the daughter of Loarn, was his mother, and from her he was called Mac Erca.

Do chuip ehpa Muipcheptach cechta o'iappaio na bopoma, ocup ni uaip ach carh oo gellao oo; ocup oo chinoil Muipchecptach pip Leichi Cuino ocup uaipli olomo Conaill Cappbpeag, mic Neill. Teagaic ena Laigniġ co bpeġaib na n-agaio oo chup chaé pe huib Neill, im Illano Mac Dunlaing, im pig Laigen; ocup cuipchep cach Deaga i mBpeġaib eruppu, ocup marbéap ann Apoġal Mac Conaill Cappbpeag, ocup Colcu Mac Cloithi, mic Cpuino, mic Feolimche Cilpan, mic Colla Da-crich, pi Airgiall; ocup bpipeep pop Laignib in cach pin, ocup caéca imoa aili, cop choboig cen chath in bopoma in cén po bi beo iapum. Ip oo ni cathaib pin oo chuip Muipcheptach .i. cath Eibline, ocup cath Maigi Ailbe, ocup cath Almaine ocup opcain na Cliach pop Laignib, ooi noeipaio:

Their ambassadors were sent by Muirchertach to demand the Boru, and he did not obtain it, but a promise of a battle instead. And Muirchertach assembled the men of *Leath-Cuinn* and the nobles of the race of Conall Earrbreagh, the son of Niall. The Lagenians came to Bregia against them, under the conduct of Illann, the son of Dunlaing, King of Leinster, to give battle to the Hy-Niall. And the battle of *Deata*, in Bregia, was fought between them, in which were slain Ardgal, the son of Conall Earrbreagh, and Colcu, son of Cloithi, son of Crunn, son of Fedhlimidh Casan, son of Colla Dacrich, King of Airgiall; and the Lagenians were defeated in this battle, and in many others, so that he raised the *Boru* without a battle, while he lived afterwards. Among those battles fought by Muirchertach, were the battle of *Eibhlinne* and the battle of *Magh Ailbhe*, and the battle of *Almhain*, and the devastation of the *Cliachs* against the Lagenians; of which was said:

Cuic Chinoeich, cuic Almaine,—
Fa h-aimpip aipopipe ampe;—
Opcain na Cliach, cath Cione,

Ocup cath Maigi Ailbi.

The battle of *Cinn-eich*, the battle of *Almhain*,—
It was an illustrious, famous period;—
The devastation of the *Cliachs*, the battle of *Aidhne*,
And the battle of Magh *Ailbhe*.

Muirchertach, according to Tighearnach, perished in the house of Cletty, over the Boyne, in 534, after a reign of twenty-four years. His death, and the manner of it are recorded in the Annals of Ulster thus:—"A. D. DXXXIII. *Demersio Muircertaig, filii Erce, in dolio pleno vino, in arce Cletig supra Boin.*"

It appears from all the authorities that Muirchertach was a Christian; and he should therefore be regarded as the first Irish monarch who was so. In the

* This quatrain is also quoted by Tighearnach, who ascribes it to St. Patrick.

record of his death given by Tighearnach, the following fragments of very ancient poems are quoted, to the understanding of which it is necessary to premise that, according to a curious Irish tale, a copy of which, on vellum, is preserved in the Library of Trinity College, Dublin, (H. 2. 16, p. 316.) this monarch fell a victim to the revenge of a concubine named *Sheen*, for whom he had, for some time, abandoned his queen, but whom he afterwards consented to put away at the command of his relative St. Cairneach of Tuilen. This concubine, according to the tale, which is of a wild and imaginative character, having lost her father, mother, sister and others of her family, who were of the old tribe of Tara, by the hand of Muirchertach in the battle of Cirb, now Assy on the Boyne, threw herself in his way and became his mistress for the express purpose of wreaking her vengeance upon him with the greater facility. And the story states that she burned the house of Cletty over the head of the monarch, who, when scorched by the flames plunged into a puncheon of wine in which he was suffocated. These verses appear to have been quoted by Tighearnach from a very ancient copy of this tragical story. In the *Leabhar Gabhala* of the O'Clery's the first quatrain of this extract is attributed to St. Cairneach, who is said to have foretold that the king would come to this fatal end. It should also be stated that the text of these Bardic verses, as printed by Dr. O'Conor, is so full of errors as to render their meaning unintelligible, but the true reading is here restored from the *Leabhar Gabhala* of the O'Clery's, the Book of Lecan, and from the copies of Tighearnach, the Chronicon Scotorum, and Annals of the Four Masters, in the Library of Trinity College :

ST. CAIRNEACH'S PROPHECY.

Iſ om oman aꝛ ın ben,	I am fearful of the woman,
Im a ꝺuıꝺꝼı ılaꝛ ſın,*	Around whom many storms shall move,
Aꝛ an ſeaꝛ ꝺoıſcꝼıꝺeꝛ ı ꝛen	For the man who shall be burned in fire
Foꝛ ꝛaeb Cleıꝛıch baıꝺꝼeaꝛ ſín.	On the side of Cletty wine shall drown.
Sın ın ben ꝓo maꝛb ꝛhu,	*Sin* is the woman who kills thee,
A Mec Eꝛca, maꝛ ıo chıu ;	O, son of Erca, as I see ;

* Im a ꝺuaıꝺꝼı ılaꝛ ſın. This line is intentionally made oracular, so as to convey a double meaning, like the responses of ancient oracles, and seems to have been put into the mouth of St. Cairneach by the writer of the tragical death of Mac Earca. The verb ꝺuaıꝺꝼı would also mean *will report ;* and ſın, the last word in the line, which signifies *tempest* or *storm*, might be taken for the name of Mac Earca's concubine.

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Bio imoa a hanmanna bur,	Many shall be her names here,
Cuiprio nech for aineólur.	She will put one astray.
Ni h-ammain in ben,	Not loving the woman
Dianao comainm Sin,	Whose name is *Sin*,
Mo daig in rig loiscer ten;	For whose sake fire shall burn the king;
I tig Cleitich baiórió fin.	In the house of Cletty wine shall drown him.
Sin said, in telling her names:	
Is mise Taetan in gen,	I am Taetan, the woman,
Do cer airech Neill;	Who shall slay the heir of Niall;
Is Gamadaig mo ainm,	Gamadaig is my name,
In cać airm ar ren.	In every place and road.
Osnad, Easnad, Sin cen oil,	Osnad, Easnad, Sin, without reproach,
Gaeć, Garb ocur Gemadaig,	Gaeth, Garbh, and Gemadaig,
Ocsad, Iaetad, raó cen gai,	Ochsad, Iachtad, saying without falsehood,
Ite m'anmanna ar aen cai.	Are my names in one way.
Cennfaela *cecinit*:	
Fillir in rig Mac Erca	The King Mac Erca returns
Illeith hua Neill,	To the side of the Hy-Niall,
Sirit fuil ferru	They seek the blood of men
A muig brogair cricha Cein.	In Magh Brogais, of the country of Cian.*
Fa reć feraib nai cairpthiu,	Seven times he fought nine battles,
Ocur bio cian bur cuṁain,	And long it shall be remembered,
Do berc giallu Ua Neill,	He obtained the hostages of the Hy-Niall,
La giallu muigi Muman.	With the hostages of the plain of Munster.

It should perhaps be added, that, according to the historical tale already noticed, the interference of St. Cairneach with King Muircheartach was instigated by his queen, Duaivseach, the daughter of the King of Connaught, whose spiritual adviser he was, and that Cairneach, on coming to the house of the king at Cletty, to remonstrate with him, having been refused admittance, became filled with religious indignation, and, erecting a monument for the monarch, ascended it, declared his reign at an end, and pronounced a curse on the dishonoured mansion and its locality, in the following words:

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*The meaning of this line appears from the tale already noticed which states that, when St. Cairneach ratified a league of friendship between the Hy-Niall and Kianachta, he mixed the blood of both tribes in one vessel, and then wrote the conditions on which peace was established between them. "Do gnitcer iarum cobać ann fin eturru, ocur cumaiscid Cairneech a fuil in oen leastar diblinib; ocur scribur aṁail do ronsat in cobać ann sin."—H. 2. 16, p. 316.

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Duma na clog ro co brath,
Fodera no sinsa cach,
Leace in sreinsir Mic Erca,
Nir ba slaid a imeacha.

Mallace forr an sulang-si—
For Cletiu cerub cuana;
Nar ar maith a ith na a bliadh,
Sur ar lan d'fuath is d'anmidh.

Nar ob ann rig na ruirech;
Ni oig neach arr co buidech.
Dia cumain lim-sa rem la
Leace rig Erenn 'sin duma.

The mound of the bells this for ever;
For the future all shall see it,
The monument of the hero Mac Erca,
Whose proceedings were not feeble.

A curse [be] upon this hill—
Upon Cletty of beautiful hillocks;
May not its corn nor its milk be good;
May it be full of hatred and misery.

May neither king nor chief be in it;
No one shall depart from it grateful.
I shall remember during my day
The monument of the King of Erin in the mound.

Ro ercain Cairnech sra in sin ann sin, ocus ro benn a chloce ann, ocus canuic arr iar sin co bron ocus da doirri.

Cairnech then cursed the *Dun*, and rang his bell in it, and afterwards departed under sorrow and sadness.

That the preceding verses, though very ancient, as their language shews, are of a later date than the time referred to, can scarcely be doubted; yet the fact which they record is at least historical, and the form of the malediction is likely to be also true, as it seems certain that in consequence of the saint's curse, the house of Cletty was for ever after deserted by the Irish princes.

V. *Tuathal Maolgarbh*, the great grandson of Niall, succeeded, according to Tighearnach, in 534, and, after a reign of eleven years, was killed in 544, in the battle of *Greallach Eilte*, at the foot of Slieve Gamh, in Leyny, in the County of Sligo. Nothing remarkable is recorded of the reign of this monarch, except that, like his predecessors, he forced the Lagenians, after a successful battle, to pay him the Borumean tribute, which he received without further contest during the subsequent years of his reign. The annalists do not record the celebration of the *Feis-Teamrach* either in the reign of this monarch or in that of his predecessor.

VI. *Diarmaid Mac Fergus Ceirbheoil*, who was also a great grandson of Niall the Great, succeeded, and, after a reign of twenty-one years, according to Tighearnach and the Annals of Ulster, was killed in 565, at *Rathbeg*, in Moylinny, in the now County of Antrim. His head was buried at Clonmacnoise, and his body at Connor, near where he was killed.

Though this monarch was, at least nominally, a Christian, yet it is curious

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to observe that there is the clearest evidence that Druidism still lingered in the country during his reign, and even that Dermot himself kept a Druid in his service. These facts appear from a notice of the battle of *Cuil-Dreimne*, as given in the Annals of Tighearnach, and still more distinctly from an account of this battle in the *Leabhar Buidhe* of the Mac Firbises of Lecan, a vellum MS. of the fourteenth century, preserved in the Library of Trinity College, Dublin, Class H. 2. 16, p. 873:

Tinolid Colum Cilli Ua Neill in Tuaiscirt do dul a comairci for Diarmait. Tecait leis iarum Fergus ocus Domnall ua Mac Muirchertaig Mic Erca, ocus Ainmire Mac Seona, ri Cinéoil Conaill, ocus Ninnid Mac Duach, ocus Aed Mac Eochach Tirmcarna, co Connachtaib leo. Do gu Fraechan Mac Tenisan, tiopru, ocus Diarmait, airbi oruso esin in da fluag. Is ann sin ar bere Colum Cilli iste:

A Dia cio nach n-oingba oino[1]
In cia sur in nesmair ar a lin?[2]
In e-sloig do boing breatha sino,[3]
Slog do cing a eimceall cairn!
Is mac ambés no sor marn.
Is e mo Drai, nim epa,[4]
Mac De is firne co n-geba.[5]
Is alainn fesar in luath.[6]
Gabar Saeasin iar in fluag?[7]
Fo la Saeasin fuile buide,
Serao a hes. fuirri.[8]

Columbkille assembled the Hy-Niall of the North to revenge his protegee on Diarmait. There came with him then Fergus and Domhnall, the two sons of Muirchertach Mac Erca, and Ainmire, son of Sedna, King of the Kinel-Connell, and Ninnidh, son of Duach, and Aedh, son of Eochaidh Tirmcharna, having the Connacians with them. Fraechan, son of Tenisan, the Druid of Diarmait, then made the *Druidical Airbhi* between the two hosts. Then Columbkille said this:

O God! why wilt thou not drive from us
This mist which envelopes our number?
The host which has deprived us of our judgment,
The host which proceeds around the *carn!*
He is a *son of storm* who betrays us!
My Druid,—he will not refuse me,—
Is the Son of God and truth with purity.
How grandly he gives the onset—
The steed of Baetan before the host!
Power by Baetan of the yellow hair,
Will be gained from Erin on him [the steed].

[1] A dia, cioo nad oingba an cia, Dur a n-esmair isi a lin.—*Chron. Scot.*

[2] In ceo durr in fuirmeir a lin.—*Ann. Tig.* H. 1. 18, p. 60.

[3] An e-fluag do boing breatha oin.—*Ann. Tig.* An e-fluag do boing beatha oin.—*Four Masters.*

[4] Ni mela, i. e. It is no reproach.—*Chron. Scot.* Columbkille here alludes to the Druid of King Dermot, who was engaged in pagan incantations.

[5] Mac De ir tuim co n-geba, i. e. The Son of God, and may he side with me.—*Ann. Tig.*

[6] Ir alainn fesar in luath.—*Ann. Tig.*

[7] Gabar Saeasain fer in fluag.—*Chron. Scot.* "I am Gobar an ean ir eadh, é an ean ir Gabar."—*O'Clery.*

[8] Serag a h-Eren fuirre.—*Ann. Tig.* and *Chron. Scot.* Baetan afterwards became king of Ireland.

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Tic Tuatan Mac Dimai, mic Sarain, mic Cormaic, mic Eogain, mic Neill, ocus cuirio inn airbi n-Druad tar a cheann, ocus lingid tairsi, ocus beanais imgai do'n leith naill, ocus marbtar he, ocus is e aen fer nama rainic bas do muintir Coluim Cilli.[9] Maid for Diarmait iar sin.

Tuatan, son of Dima, son of Saran, son of Cormac, son of Eogan, son of Niall, came and put the Druidical *airbhi* over his head, and sprang over it, but he was met by a javelin from the other side and killed; and he was the only man of Columbkille's people who was killed. Diarmait was routed after that.

The record of this battle, as given by Tighearnach, is nearly to the same effect, but its text, as printed by Dr. O'Conor, is quite corrupt, and the translation of it totally erroneous; as for example, the phrase airbi n-druad, the Druidical *airbhi*, or charm, is translated "*ut expelleret Druidas*," though, as the passage above shews, the airbi was in reality the charm, whatever that may have been, which the Druid of Dermot had placed between the armies.

It was in the reign of this monarch that the last *Feis*, or assemblage of the Irish states, was held in Tara, as thus recorded by Tighearnach, at the year 560:—"*Cena postrema* Temrach la Diarmait Mac Cerbuill." i. e. The last *Feis* of Temur by Diarmait Mac Cerbuill.

From the following passage in the Yellow Book of the Mac Firbises, (p. 871,) it would appear that two other meetings were held in the same year, one at *Uisneach*, in Westmeath, and the other at *Tailltean*, (Teltown) in East Meath:

Do gnitep mordail Uisnig la Diarmait ocus la fera Erend i m-Belltaine: ár robdar iad tri ard dala Erend is a n-aimsir sin .i. Dal Uisnig i m-Belltaine, ocus Oenach Tailltean im Lugnassad, ocus Féis Temrach im Samain, ocus cebe no thiced

The convention of *Uisneach* was celebrated by Diarmait and the men of Ireland in May: for there were three great assemblies convened in Ireland at this time, namely, the assembly of *Uisneach*, in May, the fair of *Taillteann*, in August, and the *Feis* of Temur, in November;

[9] This passage is more correctly given in the MS. Annals of Tighearnach thus:—"Fraoćan, Mac Tenussain a se do rine ind airbe n-druad do Diarmoid. Tuatan, Mac Sarain, mic Cormaic, mic Eogoin is é ro la in airbe druad dar a ćeann. Magline ro ćing tairsi *qui solus occisus est.*" And still more distinctly by the Four Masters thus:—"Fraochan Mac Tenussain, as e do rigne ind erbe n-druad do Diarmaid. Tuaťan Mac Dimmain, mic Sarain, mic Cormaic, mic Eoġain, as e ro la ind erbe druad dar a ceno. Tri mile tra is e torchair do muintir Diarmada. Aoinfer issed torcair do'n leiť naill,—Maglam a ainm. Ar as é ro ching tar an eirbe n-druad." i. e. Fraochan, the son of Tenussan, was the person who made the *Erbhe Druadh* for Diarmait. Tuathan, son of Dimman, son of Saran, son of Cormac, son of Eogan, was the person who put the *Erbhe Druadh* over his head. Three thousand was the number slain of Diarmait's people. One man only was slain on the other side; Maglam was his name. For it was he that sprang over the *Erbhe Druadh*.

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ampṙib o peṙaiḃ Ḟṙinn ṙa ḃṙoḃa ḃaṙ in ti no milleaḋ in catha ṙin.	and whoever of the men of Ireland refused to attend those meetings, or violate this regulation, was considered an enemy unto death.

The reign of Dermot is, however, most memorable, as that of the last monarch who held his residence at Tara, as, according to all the ancient authorities, it was abandoned after his death in 565, in consequence of the curse of St. Ruadhan, the patron of Lorrah, in the County of Tipperary. This fact is thus stated in an ancient Irish poem on the dates of the desertion of the palaces of the different Irish kings:

O ṙeimiop Ḋiaṙmaḋa ḋuinn,	From the reign of Diarmait, the brown [haired]
Mic Ḟheaṙguṙa, mic Chonaill,	Son of Fergus, son of Conall,
O bṙeiṫiṙ Ruaḋáin aṫ éoiġ	From the judgment of Ruadhan on his house,
Ni ṙaiḃ ṙiġ a ḃ-Teaṁṙoiġ.	There was no king at Temur.

MS. Trin. Col. H. 1. 17, fol. 97, p. 2.

The cause assigned by the poets and monkish chroniclers for the abandonment and consequent ruin of this most ancient residence of the Irish kings, is, as usual, of a somewhat legendary character. It is thus related in the Book of Clonmacnoise, as translated by Connell Mac Geoghegan in 1627:

"King Dermott, to mak manifest unto his subjects of the kingdom his magnificence, apointed a sergiant named Backlawe, with a speare, to travaile through the kingdom, with power to break such doores of the nobilities as he should find narow in such manner as the speare could not enter into the house thort wayes, or in the breadth of the doores.

"The sargiant travailing to and fro' with his directions, putting in execution the king's pleasure in that behalfe, by breaking of either side of such doores as he could find unfitt for that purpose, untill at last he came to the house of one Hugh Gwarey, in I maine in Connaught, where being desired by those of the house to enter in the absence of the said Hugh, the sargiant said, he could not bring in his speare as he ought. Noe, said they of the house, wee will break the doore of either side, and make it in such manner as you may bring in your speare, as you desire, which they accordingly did. The sargiant haveing the doore broken, entred and feasted with them; and soon after Hugh Gwarey came to the towen, and seeing his doore broken, he asked who brok it, and being tould that it was Backlawe, the king's sergiant, he entred the house in a rage, and without much a doe killed the sargiant presently, and tooke his flight himselfe to Roadanus Abbot of Lohra, who was his mother's brother, thinking by his sanctitye and meanes to secure himselfe from the king's furie for killing the sargiant.

"Roadanus sent his said nephew to the King of Wales, who was his well-wisher, and one in whome hee reposed great trust. The King of Ireland heareing of the killing of his sargiant by Hugh Gwarey, caused narrow search to be made for him, and understanding that he was sent to the

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King of Wales, wrote to him that he should send him back, or refuseing soe to doe, that he with all his forces would goe over to him, and destroy his kingdome, and remaine there untill he had found Hugh Gwary, which the King of Wales perseaveing, sent him back to Roadanus the abbot againe.—When King Dermott understood how he was sent over, he prepared to come to Lohra with a few of his guard, and in his coach came to Lothra aforesaid, and sent one of his men to know where Hugh Gawry was. The man looked about him, and could see none but Roadanus, that sate in his accustomed chaire or seat, where he did use to say his prayers, under whose feet, or neere adjoyning, he caused a hole to be made in the flooro, for Hugh Gwary to rest in, whereof nobody had knowledg but Roadanus himselfe, and one more that carried him his meat at the times of refections. The king, seeing the man brought him noe tydings, he entred himselfe, and was confident, Roadanus being inquired of the place where Hugh Gawrey was, would not lye, but tell truth as was his custom. The king accordingly entred, and saluted him with harch salutations of bitter and pinching words, such as were unfitt to be spoken to such a holy and vertuous man, saying that it did not belong to one of his coat to shelter or keep in his house, one that committed such a fact, as to kill his sargiant that was imployed in the execution of his instructions, and prayed that there would be noe abbott or monk to succeed him in his place in Lothra. By God's grace, said Roadanus, there shall be abbots and monkes for ever, and there shall be noe kings dwelling in Tarach from hence forward. When they had thus bitterly spoken, the king asked where Hugh Gawry was; I know not where he is said Roadanus, if he be not where you stand, for soe he was indeed right under the king's feet. The king thinking he spoke in jest, departed, and being out of the house, thought with himselfe, that the holy man spoke truth, and that Hugh Gwarey was under the place where he stood, and sent one of his men in againe with a pick-ax to digg the place, and to bring him out by force. As soon as the man came to the place, he struck the earth with the pick-ax, his hands lost all their strength on the sudaine in such manner as the party could not lift the pick-ax from the ground, then he cryed mercy, and besaught Roadanus for forgiveness and remission, with his benediction, which Rodanus accordingly gave him, and kept the man thenceforth with him in the habitt of a monke. The king seeing him not returning entred himselfe, and caused the hole to be digged, where he found Hugh Gwairie, whom he carried prisoner to Tarach.

"Roadanus seeing himselfe violently abused, and bereft of his kinsman, sent for others of the church, and followed the king to Tarrach, and there craved Hugh Gawry of the king, which he absolutely refused. After supper the king with the nobles of his court, and prelates of the church, went to bed, and about midnight the king being heavely asleep, dreamed that he saw a great tree that rooted deeply into the earth, whose lofty top and braunches were soe high and broad, that they came neare the cloudes of heaven, and that he saw 150 men about the tree, with 150 broad-mouthed sharp axes cutting the tree, and when it was cut, when it fell to the earth, the great noyse it made at the time of the falling thereof, awaked the king out of his sleep; which dream was construed, interpreted, and expounded thus:—that this great tree, strongly rooted in the earth, and braunched abroad, that it reached to the very firmament, was the king whose power was over all Ireland; and that the 150 men, with sharp axes cutting the tree, were these prelates saying the 150 Psalmes of David, that would cut him from the very rootes to his destruction, and fall for ever. When the morning came the king, nobles, and prelates arose, and after the clergymen had don

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with their prayers, they besaught the king againe to enlarge unto them Hugh Gwairye, which he did as absolutely refuse as hee did before; and then Roadanus and a bushop that was with him tooke their bells that they had, which they rung hardly, and cursed the king and place, and prayed God that noe king or queen ever after would or could dwell in Tarach, and that it should be wast for ever, without court or pallace, as it fell out accordingly. King Dermot himself nor his sucessors kings of Ireland could never dwell in Tarach, since the time of that curse, but every one of the kings chose himselfe such a place as in his one discression he thonght fittest, and most convenient for him to dwell, &c., as Moyleseacluin more, Donasgiah; Bryan Bowrowey, Kyncory, &c. Roadanus being thus refused, he tendered a ransom of 30 horses, which the king was content to accept, and soe granted him Hugh Gwairye."—*MS.* in *Trin. Col. Dub.* F. 3. 19, p. 45, *et seq.*

The same account, but at greater length, is given in an Irish manuscript in Trinity College, class H. 1. 15. It is also given in the chapter, "*Qualiter maledixit Themoriam,*" in the Life of St. Ruadhan, in the *Codex Kilkenniensis,* an ancient vellum MS. of Lives of Saints, in Marsh's Library, Class V. 3. Tab. 1. No. 4. F, and in the life published by the Bollandists, at the 25th of April, from the *Codex Salmaticensis.*

The detail of circumstances connected with this event, as above given, are, it must be confessed, strongly marked with those marvellous incidents which characterize the writings of the middle ages; yet, there is no reason to reject the groundwork of facts on which the superstructure of fable has been raised, and which appears simply to have been, that the monarch Dermot had for some offence captured the relative of the Saint of Lorrah, and that the latter in the manner usual with the saints of that age, took revenge by cursing him and his palace, a curse which in a superstitious age had the effect of deterring the succeeding monarchs from residing there. It cannot indeed admit of doubt that Tara was abandoned at that period: the malediction of Ruadhan, with its consequences, is referred to by the ancient Scholiast on Fiech of Sletty's Irish Poem in praise of St. Patrick, preserved in the *Liber Hymnorum;* and an ancient Icelandic work called the *Konungs-skuggsio,* or Royal Mirror, states that it had been abandoned and utterly destroyed, in revenge of an unjust judgment pronounced by a king who had once ruled over it.—See *Johnstone's Antiq. Celto-Scand.* p. 287, *et seq.*

This desertion of Tara, in consequence of the malediction of an ecclesiastic, affords a striking, but, as already shewn, not a solitary example of the power of the clergy in a superstitious age; for, though the Irish monarchs continued to

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take their title from this distinguished place from the death of Dermot till the extinction of the monarchy, it seems quite certain that it was never after used as a royal residence. This remark was necessary, as some popular modern historians, finding the title of King of Temur applied in the ancient authorities to the later Irish monarchs, have fallen into the error of supposing that their residence was still at Tara. It appears, however, that these monarchs had never after any fixed or common residence, but that, as the Book of Clonmacnoise states, in the extract just given, and also according to the *Leabhar Buidhe Lecan*,—col. 321,—each of them chose for himself a residence most convenient or agreeable, which residence was usually, if not always, within their own hereditary principalities. Thus the kings of the family of the northern Hy-Niall appear to have resided chiefly at their ancient fortress of Aileach, near Derry, and those of the southern Hy-Niall, first, at the Rath, near Castlepollard, now called *Dun-Torgeis*, having afterwards become the residence of the Danish king, Turgesius, and subsequently at *Dun-na-Sciath*, on the margin of *Loch Ainninn*, now Lough-Ennell, near Mullingar.

From the preceding historical notices, it will not appear surprising that a spot of such ancient importance as Tara should have been a favourite theme not only with the ancient bards, but also with most of the modern antiquaries and historians of Ireland; or that the latter should indulge in the common, though foolish national vanity of exaggerating its claims to architectural splendour, by vague references to ancient authorities which they never allowed to see the light. To expose the errors in the accounts given of Tara by O'Conor, Vallancey, and others, would be but an idle combat with shadows. However gratifying they may have been in their day to the Milesian national vanity, they have made but little impression on the cooler minds of the uninterested, or unprejudiced, and are now wholly disregarded. The existing remains, though but time-worn vestiges, are the best evidences of the original character and extent of the works which a people not far advanced in civilization raised in distant ages; and whatever claims to truth the ancient accounts of the place may have, they must now rest on their agreement with these vestiges.

It will be seen from the accompanying plan of the earthen works still exist-

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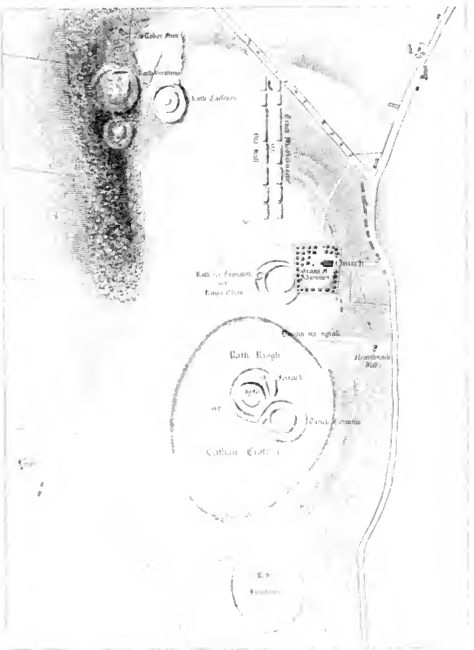

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ing on the hill of Tara, that, to use the words of Stanihurst, "doubtless the place seemeth to bear the shew of an ancient and famous monument;" and it will also appear, from an examination of the ancient Irish accounts of these remains, that their origin is not assigned to a period which may properly be regarded as beyond the limits of true Irish history. It should not, indeed, be expected that such accounts would be wholly free from fable, particularly in whatever relates to the earlier national traditions; but it should be anticipated that the names and particular descriptions of the state of the monuments at the time would necessarily have the character of truth, as there could be no inducement for fable in such matters; and that they really have this veracious character will appear quite manifest from their agreement with the present vestiges of the monuments to which they refer.

The principal ancient Irish tracts written in illustration of the origin and names of Tara, and describing the localities, &c. of the hill and its monumental remains, are preserved in the ancient topographical work called the *Dinnseanchus*, a compilation of the twelfth century. Most of the documents found in this work are, however, evidently of an earlier age, though in many instances not of the antiquity ascribed to them; and though some of them are of little value to the present investigation, it has been thought advisable to present them to the reader without mutilation or selection; for, however worthless in other respects, they are of importance as monuments of the ancient Irish language, and as shewing the character and real value of the bardic history of the country.

The first document in this collection is a short treatise in prose, explaining the meaning and origin of the various names by which the hill of Tara was anciently called. It is ascribed to Amergin, a poet of the sixth century, and is followed by a poem to the same effect, ascribed to Fintan, a poet supposed to be of the same age, but of whom many fabulous accounts are given by the Irish Bards. They are as follows:

Dinnseanchus Erenn anseo, do rigne Amergein, mac Amalgada, mic Mailerua-ain, do na Deisib Temrach, ba fili sen Di-armada, Mic Cearbaill. Is e do rad ailgius for Fintan, mac Bocna i Temraig, dia mbai mordail fear n-Erenn i Temraig, im rig n-Erenn, im Diarmaid, Mac Cer-

The Dinnseanchus of Ireland here, made by Amergin, the son of Amalgaidh, son of Maelrain, of the *Desii* of Temur, who was the poet of Diarmaid, the son of Cearbhall. It is he that made the request of Fintan, the son of Bochna, at Temur, when there was an assembly of the men of Ireland at Temur, with the King of Ireland,

baill ocur im Flann Febla, mac Scannlain, comarba Paetraic, ocur im rai feap n-Erenn, im Ceanoraelaib, mac Aitiolla, mic Eogain, mic Neill, agur im Fhinntain, mac Bochna, aproeanoip Erenn; ocur co po eroirc Amirgein eri laiée ocur eri hainée por Fintain, i fiasnairi feap n-Erenn, rceo mac ocur ingein, i Temraig; conericcip oo feanéarai fipa aino n-Erenn, roiers po lao caé oume ocur caé oine oi o aimrir Ceaipra ingine Beaca, ir i ceona po zab Erc, go plaié n-Diarmaoa Mic Ceairbaill; co n-epert.

Temup, om, ol Amairgen, mup Tea, ingin Luigéach, mic Icha, ora luio co Zeoi n-Ollgoéach. Ir na flaiéren ba binoirp la caé noume in Erc gué aparle beoir reoa imo éroi, ap meo in ertoa ocur na cairoine bae la cach oiarail in Erinn; conio aipe rin ir fpuiéul in mup *fingualis* zaé mup polúé. Ice ceona paer cuip h-Erenn cuip Tea, inginu Luigéach, fri Zeoe.

No Temair .i. Tephimup .i. Mup Tephi, ingini Bachtin, ri hifpainn. Ir i bai ic Canthon, mac Caiémenn, ri Bretan; cop bo marb occo hi; ocur oo finoo Erinn ioal na m-Bretan fri a cairez ca mbao beo no marb hi. Rugao hi iarum tar na bar co hearann, co noeapnaio mup impi amo .i. Tephi mup. Ar éonnaipc Tea om bean Eremoin imrin .i. mup Tephip; luio fen oon co h-Erinn le a feap, ocur oo berean oi each eulach eogan in h-Erinn, conio le iarain con apneée mup aimail mup Tephip conao inoi po aonaée; *unde* Temair *dicitur*. Temair ocur Druim Cain ocur Liaé druim ocur Caéair Crofinn ocur Druim n-Derc, cuig anmanna Temrach in fin.

Vel ita, Temair. *A verbo Graeco* Te-

Diarmaid, the son of Cearbhall, and with Flann Febla, the son of Scanlan, Coarb of Patrick, and with the learned men of Ireland, with Kinfaela, the son of Ailill, the son of Eogan, the son of Niall, and with Fintan, the son of Bochna, chief senior of Ireland; and Amergin fasted three days and three nights on Fintan, in the presence of the Irish, both sons and daughters, at Temur; so that he (Fintan) manifested unto him the true histories of the *Dinns* of Erin, and the proceedings of every person and every tribe of it from the time of Ceasair, the daughter of Bith, who was the first that took Ireland, until the reign of Diarmaid, the son of Cerbhall; so that he said:

Teamuir, then, said Amergin, is *múr Tea*, i. e. the wall of *Tea*, the daughter of Lughaidh, son of Ith, who went to Geide Ollgothach. In his reign, the voice of each other was sweeter to the men of Ireland than the strings of the harp, from the greatness of the peace and friendship that each had for the other in Erin; so that this *mur* was more melodious than any *mur* in existence. The first royal crime of Ireland was the crime of Tea, the daughter of Lughaidh, with Gede.

Aliter Teamuir, i. e. *Teph-múr*, i. e. the wall of Teph, the daughter of Bachtir, king of Spain. She was married to Canthon, the son of Caithmend, King of Britain, till she died with him; and *Eliran*, the Idol of the Britons, had been given as a guarantee for her resteration either dead or alive. After her death she was brought to Spain, and a *mur* was there erected around her called *Tephimúr*. Tea, the wife of Heremon, saw this *mur*; she afterwards came to Ireland with her husband, and he gave her every hill she chose in Ireland, so that she erected a *mur* similar to the *mur* of *Tephi*, where she herself was afterwards interred; whence it is called *Teamair*. *Temair* and *Druim Cain* and *Liathdruim*, and *Cathair Crofinn* and *Druim n-Derces* are five names of Temur.

Or thus, *Temair*. Authors affirm that the

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moria, [θεωρεω?] *quod Latine interpretatur* conspicio, *hujus oppidi quod Temoriam vocamus nomen esse derivatum auctores affirmant; omnisque locus conspicuus et eminens, sive in campo, sive in domu, sive in quocunque loco sit, hoc vocabulo, quod dicitur* Temair, *nominari potest. Sic in proverbio Scotico reperitur, ut dicitur,* Temair na tuaithi, *et* Temair in taighe, *quam sententiam, in suo silencio,* Cormaccus de hoc nomine disputando, posuit. Hoc igitur opidum, multorum sive conmune, vendicat, nunc cunctis enim Hibernensibus oppidis excellens, congruenter eorum conmune vocabulum possidet; quippe cum hujus rector, usque hodie, tocius insole Scotorum monarchiam sortitur.*

name of this town, which we call Temoria, is derived from the Greek word *Temoria*, (θεωρεω?) which in Latin is interpreted *conspicio*; and every place which is conspicuous and eminent, either in a plain or a house, or in whatever place it be, may be called by this name, *Temair*. Thus it is found in this Scotic saying, *Teamair na tuaithi* and *Teamhair in taighe*; which sentence Cormac, in treating of this name, has inserted in his glossary.† This, therefore, being a town of many, or a common town, and now excelling all [other] Irish towns, aptly possesses their common name; for its ruler, even to this day, holds the sovereignty of the entire island of the Scots.

Teamair Breaġ cid ni dia da
Indisid a Ollamna!
Coin do degail rir in mbruig?
Cuin do bo Teinair Temair?
In ac Partalan na cat,
No ac cead gabail Ceasrach,
No'n ac Nemed cu nem nur,
No ic Cigal garb gligarglun?
In ac Fearaib Bolg na mbaġ
No'n ac line Luprachan?
Sloindid ca gabail dib sin
O dta Temair ar Temair.
A Thuain, a Finnchaid feil,
A Broin, a Chu alad em,

Teamhair of Bregia whence it is [named]
Tell, O Ollaves!
When did it separate from the *Bruigh*?
When was Teamhair [called] Teamhair?
Is it with Partholan of battles,
Or at the first invasion of Ceasair,
Or with Nemed of noble valour,
Or with Ciogal, the rough and knocker-knee'd?
Is it with the Firbolgs of battles,
Or of the race of Luprachan?
Tell, in what invasion of these
Was Teamhair called Teamhair.
O Tuan, O generous Finnchadh,
O Bran, O active Cu-alladh,

* This seems to be a mistranscription for some word denoting glossary [lexico!] The Irish word is *Sanasan*.

† The writer alludes to the Glossary of Cormac Mac Cullenan, in which it is conjectured that *Temhair* is derived from the Greek verb θεωρεω, *conspicio*, and the Scotic phrase Temair na tuaithe, ocus Temair an toighe, quoted as an illustration of it, thus:—Temuir .i. Temur .i. Mur Tea, ingine Luighdech Mic Ithe: No, Temuir .i. Grec ro truailned ann .i. Temoro [θεωρεω] *conspicio*: Temuir din .i. cac loc ar a m-bi aurgnam do écrib itir maġ ocus tech; *unde dicitur* Temair na Tuaithe .i. tulac; ocus Temair an toighe .i. grianán, i. e. Temhuir, i. e. *Te-mhur*, i. e. the *mur* of Tea, the daughter of Lughaidh, son of Ith. Or, it is a corruption of the Greek θεωρεω, *conspicio*. Temhuir then is every place where there is a meeting of the learned both in the plain and in the house. Unde dicitur *Temhuir* of the country, i. e. a hill, and *Temhuir* of the house, i. e. a *Grianan*. The Book of Glendalough also quotes this derivation as Cormac Mac Cullenan's.

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A Dubain,—nap coicep cain,	O! Dubhan,—ye venerable five,
Cid, on, cid dia ta Temair?	Whence so named is *Teamhair?**
Do bi tan, ba call coill ćain,	There was a time, when it was a fine hazel wood,
A n-aimpip mic ain Ollcain,	In the time of the famed son of Olcan,
No go po pleċt in ċoill cap	Until felled that knotty wood
Liaṫ mac Laigne leaṫanglap.	Liath, the son of Laigin Leathan-glas.
O pin amaċ ba Druim Leiṫ,—	From thence it was [called] *Druim Leith,*—
A h-apbup ba hapbup meith,—	Its corn was rich corn,—
No go topaċt Cain gan cpad,	Until the coming of Cain without misery,
Mac pen Fiaċa Ceindfindain.	The son of Fiacha Ceinnfinnan.
O pin amaċ ba Druim Cain,	From that time forth it was [called] *Druim Cain,*
In tulaċ cup tegdip maip,	This hill to which the great were wont to go,
No go topaċt Cpofind cain,	Until the coming of Crofin the fair,
Ingean Alloid ollbladaig.	Daughter of the far-famed Alloid.
Cataip Cpofind, nip bo cam,	*Cathair Crofinn,* not inapplicable
A hainm ac Tuaṫa De Danann,	Was its name among the Tuatha-De-Dananns,
Gop topaċt Tea nap cle,	Until the coming of Tea, the just,
Bean Epemoin go n-apdgne.	Wife of Heremon of the noble aspect.
Ro claitea clad im a teaċ	A wall was raised around her house
Ag Tea, ingin Luigḋeach,	For Tea, the daughter of Lughaidh,
Ro h-adnaċt 'n-a mup amuiġ,	[And] she was interred in her wall outside,
Conad uaiṫi ta Temuip.	So that from her is *Tea-múr.*
Fopad na pig ba hainm di;	*Foradh* [seat] of the kings was its appellation;
Rigpaid mac Miled indti;	Kings of the sons of Milidh (ruled) in it;
Cuig anmand uippi ap pin,	Five names it had before then,
O Fopdpuim gu Temaip.	From *Fordruim* to *Teamhair.*
Ip mipi Fintan fili,	I am Fintan the poet,
Nip pam egni en linni,	I was not the salmon of *one* flood,
Ip ann pom togbad ap pin,	Where I was after that raised
Ap an fod bpuġ op Temaip.	Was on the sod-fort over *Teamhair.*

* Fintan is here represented as addressing the five oldest men in Ireland, by whom the traditions of the country are said to have been preserved. These were Tuan Mac Cairill of Ulster, Finnchadh of Leinster, Bran of Burren, in North Munster, Cu-alladh of *Cruachain Conallaidh,* probably in South Munster, and Dubhan of Connaught. Fintan, himself, on whom this poem is fathered, was believed, by the old Irish Shanachies, to have lived from the time of the first colony which came into Ireland, until the reign of Dermot Mac Ceirbheoil; having during this period undergone various transmigrations. For an account of Fintan, see a curious story in *Leabhar na h-Uidhre;* and for the traditional account of the five seniors here mentioned, see the *Leabhar Buidhe* of the Mac Firbises, p. 244. O'Flaherty remarks on this legend, that it might be inferred from it that the Irish Druids held the doctrine of the Metempsychosis: "Ex hac autem fabulâ colligere est Pythagoricæ, ac Platonicæ scholæ de animarum migratione, seu in quævis corpora reditu, deliramenta apud Ethnicos nostros Druidas viguisse."—*Ogygia,* p. 4. But a more important inference, which may be drawn from it, is, that the fictions relative to the early colonization of Ireland were first concocted in the reign of Dermot.

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Cuan O'Lochain *cecinit* ro pir.*
Do beir mairi do na mnaib
Temair gan tairi ar eocharl.
Fuair ingen Luigdech na laim
Tulmaġ bud liaċ do loeharn.
Ellom ro gaid ben Gede
For a ceili, ro ċuala,
Dingna daeġlan dreim naine,
Dad aelam aine im huaga.‡
Apur, bad dun, bad daingean,
Dad daour mur cen mandup,
Forr mbiad leċe Tea iar cuinem.
Comad cuilleḋ dia hallaḋ.
Dal ic Eremon umal
Ben i nglemadon gemel,
Rug dad ceċ poga pomep,
Do roimead ceċ ni do bered.
Bregarea eneaḃ cuillmeach,
Ro cluinter uair da haimreab,
Fede forr fuil in mor Mergeċ**
In rom pelcceċ nar h-airgeab.

Ingen Foparno colin airec,
Tephi rolaim luaideċ leirg,

Cuan O'Lochain composed the following.
Gives beauty to the women
Temar without weakness after being erected.
The daughter of Laghaidh received in her hand
A hill-plain, which was sorrowful to a harlot.
The *portion*,† which the wife of Gede requested
Of her husband, I have heard,
[Was] A fair coloured *dingna* of delightful ascent,
Which she was active and skilful in selecting.
A habitation, which was a *dun* and a fastness,
Which was the glory of *murs* without *demolition*,§
On which was the monument of *Tea after her death*‖
So that it was an addition to her *dowry*.¶
The humble Heremon had
A woman in beautiful confinement,
Who received from him every thing she wished for,
He gave her whatever he promised.
Bregatea, [was] a meritorious abode.
It is heard that it was once a high abode,
[Where lies] The grave under which is the great Mergech,
The burial place, which was not violated.
The daughter of Pharaoh of many champions,
Tephi, the most beautiful that traversed the plain,

* In the copies of the *Dinnseanchas*, preserved in the Manuscript Library of Trinity College, Dublin, H. 2. 15. p. 229, and H. 3. 3, p. 2, this poem is ascribed to St. Cairneach; and it would appear from the language that it is some centuries older than the time of Cuan O'Lochain, to whom it is ascribed in the Book of Ballymote.

† In a gloss on this poem, preserved in a MS. in the Library of Trinity College, H. 2. 17, p. 871, this word ellam, which is there written eallam, is thus explained, eallam .i. coibċi: amail a deir:

Eallam ro gaid ben Gheḋe
For a ceile, ro cuala,
Dingna daeġlan dreimi neaine,
Dad aelam aine im uaga.

‡ The three copies differ in the last word of this line. In the Book of Ballymote, and in the gloss already referred to, it is written huaġa, as in the text, but in the copy preserved in H. 3. 3, the line runs thus: Da h-aelam aine m-buada, and in the one preserved in the Book of Glendalough, ḋa aelam aine im uaga.

§ In the gloss on this poem above referred to, the word mandup which is there written mannap, is explained ṙaṡleaḋ, loosening, demolition.

‖ In the same gloss this phrase iar cuinnem is interpreted iar mbáṙ, *after death*.

¶ Dia hallaiḃ .i. dia coibḋi.—*Gloss.*

** Fede for fuil in mor Mergech.—H. 3. 3.

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Rocum caṫṙaiġ, croda in cuiro, [Here] Formed a *cahir*, strong the circle,*
Dia luiġ por roṙna ir dia delg,† Which she described with her wand and bodkin.
Do rao ainm dia caṫṙaiġ caim— She gave a name to her fair cahir—
In ben ca naib raemair riġ— The woman with the prosperous royal smile—
Mur Tephi ṙuir coirge oall, Mur-Tephi, where the assembly met,
Ar era oirdeus cen ṅgraim ceċ ṅgnim.‡ And where every action was achieved without treachery.

Ni cleiri in run ria rasa, It is not a mystery to be said,
Mur dar Tephi, ro cuala, A *mur* [was raised] over Tephi, I have heard,
Foerum runo cen dual oṅġa,§ Strength this without contempt,
Cumtue morṙiġna ruama. Which great proud queens have formed.
Fad leṫeṫ eige Tephi, The length, breadth, of the house of Tephi,
Gan eneiri mioir ruiri, The learned have measured it without ignorance,
Seṫcad enaiġeo can elaiṫe, Sixty feet without weakness,
Con ṙegtao raiti ir oṙuidi. As prophets and druids have seen.
Ar cuala in Erṙainn uillġi|| Spain the angular has heard
Ingin leṫṫbaim, laeċbuillġ Of the mild, fair, comely daughter
Cino baṫeir, mac Buirriġ, Of Cino Baetir, son of Buirrech,
Dor ruġ Canton caem cuimniġ. Whom Canthon, the beautiful hero, married.
Tephi a ainm or ġaé ṅgeṫao, Tephi her name, [distinguished] above every virgin,
Mairġ ṙorr mbeṫio a murao! Wo to him who had to entomb her!
Seṫcad enaiġeo cen coluo, [A tomb of] sixty feet without addition,
Leo do ronao dia runao. By them was made to enshrine her.

Nir ruġ riġ Breoġain cen bron, The King of Braganza without sorrow did not cease,
Ciar bo meadurġ la Cuneon, Though it was defeat to Canthon,—
Co m-berṫ a hairec dia hon, Until she should be restored from her sojourn,
O ri na m-Breasan mblao mor. By the King of the Britons of great fame.

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* Cuiro .i. ceiro no obair no caeir, ut est: Rochum caṫṙaiġ croda in chuiro, dia luiġ por roṙna, ir dia delg. Agur ainail aberr buie bron ceiro Cuinn .i. cuiro Cuinn .i. caeir cuino.—*Gloss.* The word cuiro certainly signifies circle, circuit, or ambit. See *Ordnance Memoir of the Parish of Templemore*, pp. 212 and 213, where the origin of the word caeair and its cognates is inquired into.

† Dia luiġe por roṙaino ir dia delg.—H. 3. 3. Dia luiġe puṙ roṁair, &c.—H. 2. 15, p. 229.

‡ Ar noiṙeceo ġaé ġraim ġaé ġnioṁ.—H. 3. 3, and tt. 2. 15.

§ Fui ram runnai cen oiġni.—*Lib. Glendalough.* Faeṙin runn cen dual oiṅgni.—H. 3. 3, and H. 2. 15.

|| The epithet uillech, angular, and ere-uillech, triangular, is applied to Spain in old Irish poems, from which it would appear that the writers of them had a chart of that kingdom. Thus in the Book of Lismore, p. 151:

"Tar domgnar Nepruin anunn,—Go crich Fṙeṙen ic reḋum,
Ocur mo ḋerḃaiḋ dar muiṙ,—Seoch in Erṙainn ere-uillġ."

Ec ṙuaċ Ṫephi ṫaiṁiġ ṫuaiṫ,
Nip ġniṁ cleiṫe pe oen uaip
Caṁṫon po leġ luiṁġ cen luaṫġ.
Por ṫuiṁo in ṫ-ṙaili ṫ-ṙeṙḃ-ṙuaiṫ.
Coiṁoiu Caṁṫóin, ni cluí,
Ḋéṫṙun, ba heṙcṙeḋe,
Ir ṙluaġ na nġlar ḋeṙc ġleiṫí,
Uaṫo ṙri caiṙec ṫṙen Ṫephi.
Ro ṙcaṙe bur ḋṙeṫan on bruch,
Ar ba ṫcal heccṙun,
Comar blaiṫ ṙria meṙṙ don mur,
Ṫeṙ a ṫarḃlaiġ Ṫephi ṙun.
Ir ṙon ṙamla ṙin, ṙunoṫ,
Ṫinḋ ṫu ṫulma a ṫeoṫuma
Ṫempa ṫaiṫ caiṫḃlaiṙ epuma,
Ar aiḃnuṙ, ar eoṙuma.
Ṫeamair caṫ aṙo, ṫaṫ iṙġna,
Ṙoṙṙ mbio ṙoṙṫa, ṙo ṫiṁġna,

The piteous death of Tephi, who went to the north,
Was not a concealed fact for one hour.
Canthon put his ship without cheerfulness
On the surface of the bitter-reddish brine.
The *God** of Canthon, it is not concealed,
Etherun, in whom faith was placed,
And the host of the bright green eyes,
Had been pledged for the restoration of proud Tephi.
The chief of Britain shouted from the shore,
For *Etherun* was an idol—
That it would be fame and respect to the *muir*,
South in the famous shrine of Tephi.†
It was in this manner, in this place,
They nobly made the first form
Of Temur‡ (which is) without an equal
For amenity, for lightness.
Temur [means] every height, every eminence,
On which is a dwelling, a good fortress,§

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* Coimoiu, *God*; Divinity, *numen*. In the copy of this poem, preserved in the Book of Glendalough, the word eṙlaiṫi, a patron saint, or tutelary god, is substituted here for coimoiu; and in the prose account of this *Tephi*, Ḋéṫṙun is called the Idol of the Britons—iḋal na m-Ḃṙeṫan. It can be no other than the *Taran* of the British antiquaries and historians, by which they understand the chief God or Jupiter of the Pagan Britons.

† The meaning of this quatrain is very obscure, and some error has crept into the text through the ignorance of transcribers. The three copies of it differ in orthography and words, and each is equally obscure. The meaning seems to be, that Canthon took a figure of the British god Etherun or Taran with him to Spain, to be placed on the tomb of Tephi, that it might add to its fame and venerable character.

‡ The meaning is, that the tomb which was erected in Spain for Tephi was the model after which Heremon built the monument or *mur* of Tea on the hill of Temur, from which it took its name.

§ The words ṫinn, ṫinġeam, and ṫiṁġna, which seem cognate with *Ting* in the Scandinavian dialects, are of constant occurrence in ancient Irish MSS., and employed to signify a fort, fortress, or palace. The Hag's Castle in Lough Mask is, in the Annals of the Four Masters, called the ṫiṁġeam ṫaiṁġeam of Connaught. As the words ṫinn and ṫiṁġna are of such constant occurrence in these documents, and not explained in any dictionary, a few examples of their use are here given from the Book of Lismore, one of the best Irish MSS. now extant. Thus, describing a city in the east, the word ṫinn is used in the sense of tower: "Cṙi ṙoṙuṙ umaiṁ ṙop ceċ ceṫṙaiṫċim ḋi, ocuṙ Ḋinn ṫiṫoġluiṫi ṙop ceċ n-ḋoṙuṙ," &c. And again: "Ocuṙ ni le nech ḃon ċaṫṙaiġ Ḋinn na caiṙṫen ḋá ṙuil ṙop a ṙeṫ, aċt coiṁḋeṙ na ġach aen iaa ṙum."—p. 123. Again: "Do niṫṫ a ṙuaṫ oo ṙinoiu in ġaṫ Ḋinn a riġi na Ṫaṙcṙuiġeuch."—p. 111. The word ṫiṁġna is used throughout the same MS. to signify a fortress or habitation: Ar eaḃa uaim-ri ḃoiḃ, ar Aengur oġ, Mac in Ḋagḋa, i. ounaḃ ocuṙ Ṫiṁġna, ocuṙ baile riġḋa romoṙa cu ronnaċuiḃ ṙiṫ-aṙḃa, ocuṙ go n-gniaṁaiṁaiḃ gleóṙaċ, glaimḋe.—p. 190. In the same MS. Tara is called the chief ṫiṁġna of Ireland.

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Teamair ceé benn naé birróa,
Clée mao Emain for irgna.
Da eargna epnaeth ocup eop,†
Rob aoba niae neth co neim,
Teamair cen eagri, cen epaig,
Cl mairi do mnaib do beir.‡

Temur every *Ben* not pointed,*
[Exceeding all] except Emania in distinction.
It was the meeting-place of lords and chieftains,
It was the habitation of warriors of venomous contest,
Temur without weakness, without misery,
Their beauty to the women gives.

Do tuignaib na Temrach in so sis.

Nemnach .i. eippa fuil ic on e-pso, i n-airdiur tuaiscepe na Temrach. Slaiti soin teio a Nemnaig .i. Nie a h-ainm, ir fuippi a tri in ceona muilenn oa ponao i n-Ene la [*recte* do] Ciapnao cumail Copmaic.

Laéiaé eige Mairiren fil oi in aiso sin Nemnaig a cuaio, ocup teora cloca begai [imbe].[1] Ir airilliu po fuiniged in teeaé sin, Lári ano ocup cuaiaé airiseo. Mairireo, soin, banéneach bae im copae sin Cop-

Of the remarkable remains of Temur.

Neamhnach, a well which is at the *Sidh*, to the north-east of Temur. From this well flows a stream called Nith, oo which is the first mill erected in Ireland by [*recte* for] *Ciarnaid*, the *Cumhal* (bondmaid) of Cormac Mac Art.

The ruins of the *House of Mairiseo* lie from the Shee (hill ?) to the north of *Neamhnach*. There are three small stones around it [or in it]. Io its structure, this house had a high middle and low *tuarad*. Mairiseo was a widow who was co-

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* This line is corruptly given in the Book of Ballymote thus: Teamair caé benoach birróa, which would mean "Temur means every peaked and pointed hill;" but the true reading given above in the text is found in the Book of Glendalough, which is an older and more correct MS., and in the Gloss on this poem in H. 2. 17. The Book of Glendalough gives another quatrain here between the lines Clée maó Emain for irgna and oa eargna epnaeth ocup eop; but it is probably an interpolation, as it is not to be found in any other copy. It repeats the Scotic proverb, Teamair cuaeni ocup eigi, from which Cormac Mac Cullenan inferred that the word might be derived from the Greek. It runs thus:

"Teamair Cuaeni ocup eigi,—Cen luaeni, cen laeémiri,
Maéair anai caé fini,—Conop bpaeliaig beaé bini."

† The word eop literally signifies a tower, but it is here, and in many other compositions, used in a figurative sense to mean lord or chief. Tuirgin, a word formed from it, is also used to signify a pillar or post which supports a house; and also a king.—*See Cormac's Glossary and the Forus Focal.*

‡ Cl mairi for mnaib ni cheil.—*Book of Glendalough.*

[1] In the copy of the Dúnnseanchus, preserved in the Library of Trinity College, H. 2. 18, this passage is given as follows: I slaiti bec theic ó Temraig rain, ir fuippi a tri in muilenn ceta oeprae oo Chiapnaic cumail Chopmaic, a small stream which flows from Temur eastwards; on it is the first mill erected for Ciarnat, the bondmaid of Cormac.

[2] This word is omitted in the Book of Ballymote. But it is here supplied from the Book of Glendalough. In H. 3. 3, cnn, i.e. *in it*, is here used for imbe, *around it*. But it is now impossible to decide which is the better reading, as the monument is totally destroyed.

[3] Isin aino in H. 3. 3.

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mac.[4] Cáċ eeċ puroiżur in euáċ pn,[5] ni ba ouaibreaċ, ocup ni bui cen ana ano.

Raċ Laeżaire Mic Neill pripoosin a cuaio. Ceċtar primoosipi cacha apoa inee. Ocup po puroiżeó [copp][6] Laeżaire po a rcuaiḋ żaipcuo[7] pnir in cloo n-imeéċraiḋ n-aipċeṗ oepcepeach na pig paéa Laeżaire i Temraiż; ocup a ażaio po bep ic caeżaio pri Laiżniu .i. pri claino Ḋpeagail Ḃpic.[8]

Aea i ceeb Raéa Laeżaire a n-aipoer Leiṫ Maea Mopżlonaiġ .i. amur bpaebeapeach[9] po bai i pail Copmaic. Ro báoar la ano ceaṫpar oclaeċ i g-cluiṫi i ceeb Raéa Laeżaire a n-aipoer. Foepuirim Maea a ceṫpar oar cuimgil aller i ealum.[10]

Raṫ Rig i ceeb Raéa Laeżaire a cuaio. Ceiṫe epi oecpa ipruiḋiu[11] .i. Laiṫpiḋ Uige temporary with Cormac. Every house situated in that manner, was not sorrowful, nor without plenty.

The Rath of Laoghaire, the son of Niall, lies to the north of this. There are four principal doors on it, facing the cardinal points. The body of Laoghaire was interred with his shield of valor in the external rampart, in the south-east of the royal *Rath* of Laoghaire at Temur, with his face to the south, [as if] fighting with the Lagenians, i. e. with the descendants of Breasal Breac.

By the side of *Rath Laoghaire*, to the south-east, lies the *Monument of Mata Morglonnach*, a treacherous soldier, who lived with Cormac. One day, there were four youths playing at a [certain] game by the side of *Rath Laoghaire*, to the south east, Mata buried the four down to their hips in the ground.

Rath Righ is by the side of *Rath Laoghaire* to the north. There are three *decora* here, viz.:

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[4] I compe pi Copmac, i. e. cotemporary with King Cormac.—H. 2. 18.

[5] Ainlaio pin. In H. 2. 18.

[6] Copp. Supplied from H. 2. 18.

[7] Fo a rcuaiḋ eog puibni.—H. 2. 18.

[8] This is also stated by Tirechan in the Book of Armagh, *fol.* 10, *a*, 2. "Nam *Neel* pater meus non sinivit mihi credere, sed ut sepeliar in excuminibus *Temro* quasi viris consistentibus in bello, quia utuntur Gentiles in sepulcris armati promptis armis facie ad faciem usque ad diem *Erdaithe* apud magos, id est judicii diem Domini. Ego filius Neill, et filius Dunlinge *in Maastia* in Campo Liphi pro duritate odivi ut est hoc." See also *Leabhar na h-Uidhri*, in which it is stated, that Laoghaire was interred in a standing position, with his face turned to the south, as if bidding defiance to the Lagenians, the hereditary enemies of his family.

[9] Instead of amur bpaebeapeach, the copy preserved in the Book of Glendalough has amup oo Laiżnib, a soldier of the Lagenians.

[10] This sentence is given entirely different in the copy in the Book of Glendalough, thus, Oo po lic Maeea upchup oe chloich ano, co n-oeéaio pop cune a oa lepp, co n-epbaile in e-oeéaiḋ oe.

[11] The reading in the Book of Glendalough differs considerably from this. It runs thus: Ceiṫe epi oecpa ingaineá i puroiu .i. Laeḃpaiḋ ino piġ Fuiġe Chopmaic i n-aipeḃiup oepciupe na puéa allech pri paiṫ Laeżaiṙi po oepp i laeḃpaiḋ ino Fhoppaio la eaeb in piġ-fuiġe a n-ian; mup Tea eeupnu allech po oepp .i. Tea ben h-Epimoin. Liaeḃpaiuin ocup Dpuim Cain, ocup Mup Tea, ocup Cachip Cpoino, annanb Temraiż i eoppuiḋ. Ra haonaiḋe iapum Tea, ben h-Epimoin eip laeḃpaiḋ ino Fhoppaio ocup ino piġ fuiġe; conio oe pin pa ainmniżeó Temaiṙ .i. Tea-

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Cormaic i n-aiceup beccpne na pacha illeiṫ fri Raiṫ Laiġairi fo ṫeṫ; Laiṫrać in Forrach i ṫaeb Teṫaraiġ Tige Cormaic a n-aiṫi; Mur Tea a leiṫ ṫeṫ, conid o ruim ro haimmiġeḋ Temair .i. Tea mur .i. in cnoc bec fil eiṫir in da mur fo ṫeṫ ir ano a ea.

Caprac Cormaic .i. eippa fil fo ṫaeb Raṫa na Rig a nair; ocur eṫi hanmann fuirri .i. Liaiġ ocur Tippa bo finni, ocur Deirc dub: ir de aṫa,—ni ṫaeṫ a laeġ go a liaiġ. In ṫarann á Temraiġ rair, ocur aroili a Temraiġ rar.[12]

Dubo na bo[13] .i. in Glair Temrach fri Duma na n-giall[14] a nair.

Duma na n-giall, fri Laiṫrać in Forrach i n-aiceuaiḋ.

Fal i ṫaeb Duma na n-giall a ṫuaiḋ, .i. in cloć no ġeṫreo fo corraiḃ caṫ riġ no ġeḃeṫ h-Eire. Fal ainm na cloice sin .i. fo ail .i. ail fo ri.

Leṫr Con ocur Ceṫen isin Leiṫir i comarpour Raṫa Rig rar. Aṫar ni cloć ano, Leṫr Con in ṫarann, Leṫr Ceṫen aroili, conid snaṫfocal,[15]—Dom ġnir Cu

the ruins of the *House of Cormac* in the south-east side of the Rath, facing *Rath Laoghaire* to the south. The ruins of the *Forradh* alongside the ruins of the *House of Cormac* to the east. *Mur Tea*, i. e. the wall [or enclosure] of *Tea* is on the south side. From this *Teamhuir*, i. e. *Tea-mur* is named. It is in the little hill which lies between the two *Murs* to the south.

Caprac Cormac, i. e. a well which lies under the side of *Rath na riogh* to the east. It has three names, viz.; *Liaigh* and *Tipra Bo-finne* and *Dearc dubh*: hence is [the saying] ní ṫaéṫ a laéġ go a liaiġ.—The calf does not visit his physician. The one is to the east of Tara, and the other to the west.

Dumha na bo, i. e. *Glas Teamhrach*, lies to the west of *Dumha na n-giall*.

Dumha na n-giall (the Mound of the Hostages) lies to the north-east of the ruins of the *Forradh*.

Fal lies by the side of *Dumha na n-giall* to the north, i. e. the stone that roared under the feet of each king that took possession of [the throne of] Ireland. *Fal*, the name of this stone, means fo ail, the *under* stone, i. e. the stone *under* the king.

The *Monuments of Cu and Cethen* lie on the *Leiter* (slope) in the vicinity of *Rath riogh* to the west. There are two stones here; the one, the monument of Cu, the other, that of Cethen. So

mur .i. cnoc bec fil eiṫir na da mur ailech fa ṫeṫ ir ano a ea. i. e. There are three wonderful features in this, namely, the ruins of the royal house of Cormac in the south-east of the Rath, by the side of *Rath-Laoghaire*, (which is) to the south; the ruins of the *Forradh*, by the side of the royal house, to the west; the *Mur* of Tea between them, at the south side. Tea was the wife of Heremon. *Liathdruim*, and *Druin-Cain*, and *Mur-Tea*, and *Cathair Croiun*, were the first names of Temur. Tea, the wife of Heremon, was interred between the ruin of the *Forradh* and the royal house; and hence Temur was named *Tea-mur*. It is situate in a small hill, between the two *Murs*, to the south.

[12] This, which was omitted through the negligence of the transcriber of the Book of Ballymote, is supplied from H. 3. 3. The Book of Glendalough has, In ṫarann a Temair rair, alaile a Temair rar.

[13] Duma na bo in the Book of Glendalough and H. 3. 3, which is more correct.

[14] Omitted in L. Ballymot. Supplied from the Book of Glendalough.

[15] Snaṫfocal in the Book of Glendalough, and nuchfocal in L. Ballymot. The true reading is restored from H. 3. 3.

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ocup Ceéen, .i. Cu ro marb Cethen, ramail Cormac ar lár in tige co ra gab cad dirgi fore fougair na Teampach riar conarpar ann, conid ro marb bratéair in fir ro marbrom, ocup ar bere Cormac na ro marbed Cu, ocup ni éperéir aeoarpaine co ro marbad *simul*.[16]

Ata torar ir in Compan[17] o Leéc Ceéen ro éuaid, Laeg a h-ainm; riar caé n-dirga brummear. Ata laerad na Cuérad Cormaic for a bru ir in leitir or Laeg anair.

Rae na Senuo i comair Dumai na n-giall. Rae Senaid fri Fal a éuaid.

Laerad Pupaill Adomnain ir in rae rin, ocup a éror ar belaib na raéa rair, ocup a ruirt, ocup a duma fri croir anneap.[18]

Leéc Maine Mic Muinreamair fri Rae na rig anair.

Ata Laerad in tige ro loiréead for benen gilla Patraic, ocup for Lucad Mael, druid Laegaire, eid bearg o Chroir Adomnain rair-der .i. i eaeb a raéa[19] a éuaid.

[Ataas teora clocha beca i eoeb Raeha na Senad éuaid,[20] .i.] teora cloéa ro lairi forr na druidib; ire a n-ainmne .i. Mael ocup Bloce ocup Bluicni; Mael rair, ocup Bloce fo der, ocup Bluicni fo éuaid.

that it has become a common saying, "*They have acted like Cu and Cethen*," i. e. Cu slew Cethen, Cormac's butler, in the middle of the house; and he passed directly under the height of Temur to the west, where he was overtaken and killed by the brother of him whom he had slain. And though Cormac said that Cu should not be killed, no interposer overtook them until he was killed likewise.

There is a well in the *Compan* (slope) to the north of *Leecht Cethen*. Its name is *Laegh*, and [its streamlet] flows directly westwards. The ruins of *Cuchtair Chormaic* are on its brink in the *leiter* over *Laegh* to the east.

Rath na Seanadh (fort of the synods) lies opposite *Dumha na n-giall*, and to the north of *Fal*.

The site of *Pupall Adamnain* (pavilion or tent of Adamnan) is in this Rath, and his (Adamnan's) *Cross* is opposite the fort to the east, and his *Seat* and his *Mound* are to the south of the cross.

The *Monument of Maine the son of Muinreamhar* lies to the east of *Rath na Riogh*.

The ruins of the house, which was burned over Benen, the boy of Patrick, and Lucad Mael, the druid of Laoghaire, are a short distance to the south-east of *Cros Adamnain*, that is, at the side of the Rath to the north.

There are three small stones at the side of *Rath na Seanadh* to the north. These three stones were placed over the druids who were named Mael, Bloec, and Bluicni: Mael to the east, Bloec to the south, and Bluicni to the north.

[16] Co ro marbaic anoir in the Book of Glendalough, i. e. so that both were killed.

[17] For compan, the Book of Glendalough and H. 3. 3, have cobran, *a slope*.

[18] Better thus in H. 3. 3, Laérach Pupaill Adomnain fuir in rae a éuaid, ocup a éror ar belaib an da raé rair, ocup a ruirt ocup a duma fri croir a n-dear. i. e. The site of Adamnan's Tent lies north of the *Rath*, and his *Cross* opposite the two *Raths* to the east, and his *Seat* and his *Mound* south of the cross.

[19] For i eoeb a raéa a éuaid, the Book of Glendalough has i eoeb na comdne cnair dibc. i. e. At the side of the road, a little to the east.

[20] The words included here in brackets, which were evidently omitted through the negligence of the transcriber of the Book of Ballymote, are supplied from the Book of Glendalough.

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Aca Leic in abuicc fuiu anair. Ir mlaid aca in cubaid faiscc ocus fiar sec: eri eroicci nama a comur [in da lige[91]] naessamb bicc eir; ir amlaid ica in lige ocus cloch beg fo calmain in a [aiscbiur ocus alaile na[92]] sascur. Fo gabsar eri eroicid imo in sarsa fecc, a eri co lesi in fecc n-aili.

There are two mounds oorth of the *Cubhat* called *Dall* and *Dorcha*, *Dall* towards the sooth, *Dorcha* towards the west, and these [i. e. the persons interred under them] slew each other. And there is no wall between them, and the stones and the *Cubhat*,(dwarf's grave.)

Aesse da oumai fsir in Cubuo a ewaio .i. Dall ocus Dorca, .i. Dall eesr ocus Dorca eagi;[93] ocus cac fo marb araili oib. Ocus ni furl mur aesurru ocus na cloca ocus in Cubuo.

Mur na d-tri g-cogur is in the vicinity of *Long na m-ban.*

Mur na eri cogur i fail Cuingc na m-ban.

Lia na b-fian (the Stone of the Fians) is to the east of the road, opposite *Rath Senaigh.*

Lia na fian fri sligi anair,[94] ar belaib Raca Senaig.

Long na m-ban, i. e. *Teach Midhchuarta*, is to the north-west of the eastern mound. The ruins of this house are situate thus: the lower part to the north, and the higher part to the south; and walls are raised about it to the east and to the west. The northern side of it is ecclosed and small; the lie of it is north and south. It is in the form of a long house, with twelve doors upon it, or fourteen, seven to the west, and seven to the east. It is said, that it was here the *Feis Teamhrach* was held, which seems true; because as many men

Aca Long na m-ban .i. Teach Midcuarsca o'n ouma airesarac fiaresuaid. Ir amlaid ro fuirgeo tarsac in eigc sin, leic roca[95] fu ewaio, ocus a uparo ro oer, ocus comeogbail mur uimi anair ocus a niar, ir fitec[96] big an lec ewairceresc oe; ro ewaio ocus ro oer a ca a coir. Fuaic eigc roca, con oib oopsib oeg fair, no a ceaesar oeg.[97] .i. fecc fiar, ocus fecc fair. Ocus ar beraid ir ano sin oo melei Fer Temrach; oeiebir sin, ar na callaid forgla fer n-Erenn ano[98]

The *Monument of the Dwarf* is east of them. The *Cubhat* (grave) extends south-east and south-(north-?) west. Three feet only is the measurement of the two stones. There is a small *eascaid* below. This grave has a small stooe uoder ground to the east and another to the west. It is found to be three feet at one time [of measuring] and three feet and a half at another.

[91] Supplied from H. 3. 3.

[92] Supplied from the Book of Glendalough.

[93] The reading in the Book of Glendalough is thus: Dall ainm in oumai iartharaig, ocus Dorcha dan ainm in oumai airtheruig. i. e. *Dall* is the name of the western mound, and *Dorcha* the name of the eastern mound.

[94] Instead of sligi, *read*, the copy in H. 3. 3, has ligi, *a grave.*

[95] Leicthed foe forhuaid.—*Book of Glendalough*, and H. 3. 3.

[96] Ocus ir fuellire biuc.—*Book of Glendalough.*

[97] In the Book of Glendalough better thus: A ceesar oec oe doiprib imo, no a xii, *ut alii dicunt.*

[98] Thus in the Book of Glendalough: Deithbir fun or no caillea ermor fer n h-Erenn ano, ocus ir he sin in fecc i m-biu amuis. i. e. This is likely, for the greater part of the men of Ireland would fit in it, and this is the house in which the soldiers used to be.

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oo boinib, ocup ip e pin in each mop mlib amuf.

Aea ouma beg fri laeṫaé in oige i n-aṫoep ip in aiṫéno oeṫceṫeaiġ, .i. Ouma na m-ban-amuf [a ainm[29]].

Aea Compoc[30] Caelcon ocup a pach i comaṫouf in éino euaiṫceṫeaiġ oo Zuiġ na m-ban. Caelchu ano pin Mac Loairn, mic Ruaio, mic Caiṫ, oi Eoġanaiée Caiṫl, [nech oo beṫeo buaiṫe pfimcaill feṫ Muman amaé; o eaé puiṫié Ruiṫ Temṫaé[31]] Ip oia fil Tuaé Cir oc Teamṫaiġ.

Ṫreouma Nefi, ingen Echach Salbuioi, maéaiṫ Concobaiṫ, ip in chino aiṫéṫaé euaiṫceṫeaé[32] i comaṫouf éino aiṫéiṫ euaiṫceṫeaiġ Zuiṁge na m-ban.

Rath Concobaiṫ Mic Nefa i eaeb in Ṫreouma a euaio, ocup a oopuf faiṫ i comaṫouf copuṫa Cino ocup Meoi Conculainn.

Aea laeṫaé Sceié Conculainn co n-a Tul i comaṫouf na Meioi faiṫ euaio. Samlaio a eu paé cuopoma copmail fpiṫ in ealmain, ocup cnocan beag na meoon, lan na cealca oe huiṫ.[33]

Aea Sefcann Temṫach i comaṫouf Zuiṁge na m-ban faiṫ euaio. .i. Sefcann falaé beg fil i eaeb Cairn na macaioi a n-oef.

Aea Raé Zfiuine o Sefcann Temṫach a niaṫ foṫ foṫaiṫo na celcha.[34]

would fit in it as would form the choice part of the men of Ireland. And this was the great house of a thousand soldiers.

There is a small mound to the south-east of the ruin of this house in the southern end, called *Dumha na m-ban-amus*.

The *Grave of Caelchu* and his *Rath* are near the northern head of *Long na m-ban*. This Caelchu, the son of Loarn, son of Ruadh, son of Cas, was one of the Eoganachts of Cashel, and the most distinguished of all the men of Munster for wisdom; and from him the chiefs of *Ros-Teamrach* and the tribe of *Tuath-Cis*, at Temur, are descended.

The *Treduma* (triple mound) *of Nesi*, the daughter of Eochaidh Salbhuidhe, the mother of Concobhar, [Mac Nesa,] at the north-eastern end near the north-east head of *Long na m-ban*.

The *Rath of Concobhar Mac Nesa* alongside the *Treduma* to the north; its door faces the east opposite the *Ceann* and *Medhi* of *Cuchulainn*.

The ruins of *Sciath Chonchulainn* and its *Tul* are near the *Medhi* to the north-east. The *Rath* is level with the ground, and there is a small hillock in its centre *lan na teala de huir*.

The *Sheskin* of Temur is close to *Long na m-ban* to the north-west. This dirty little *Sheskin* (moor) is south of *Carn na macraidhe*.

Rath Grainne (Grania's fort) is west of the *Sheskin* on the height of the hill.

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[29] Supplied from the Book of Glendalough.

[30] Cubae in the Book of Glendalough, and cuuae, which is intended for cubae in H. 3. 3. The word is used in the oldest Irish MSS. to signify a tomb or grave.

[31] Supplied from H. 3. 3.

[32] Aiṫeṫ euaiṫceṫeaé in the Book of Glendalough, which is the correct reading.

[33] Thus in the Book of Glendalough: Ip amlaio a eu paéh copmail cuopoma foi fin ealmain, ocup epuaichine beop in a meoon; lán inoella oe úiṫ. In H. 2. 16, better thus: Ip amlaio aeu paeh cuopoma copamail fpiṫ in ealma n ocup cnocan bec 'na meoon, lán na cealca oia húiṫ.

[34] Foṫ foṫaiṫo na culcha, in the Book of Glendalough.

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Ceu Foehaċ Racha Ġrainni a ευαιο[a] Fan na carbaɔ i comarbuṗ na Claenfeṗta ευαιṗceṗaiġi ṗaiṗ.

Ceuc na oi Claenfeṗta fri Raich Ġrainn a miaṗ. Is ni Claenfeṗta oeṗceṗaiġ ṗo oṗc in ingenaiɔ la Laiġniu ɔia Samna. Is in Claenfeṗta ευαιṗceṗaiġ ṗuɔ Luġaiɔ [Mac Con[b]] in ġubṗeiċ is in ġlaṗin ɔo oṗġain ɔo na caiṗáiɓ[c]

Ceu Caṗn maceaṗaiɔi Laiġen i caeb Seṗcaine Temṗach a ευαιο.

Ceu Cṗoṗ Feṗġuṗa noebaiṗleiṗ. (Is e ɓoi i Caṗṗaiċ Clumain,) i caeb Caṗn na maceaṗaiɔi a miaṗ.[a]

A ευ Deṗeal Temṗach eoiṗ ɔa Caṗn na maceaṗaiɔ .i. eoiṗ in caṗn oeṗceṗeaċ ocuṗ in caṗn ευaiṗceṗeaċ.

Ceu Caṗn maceaṗaiɔi hua Neill i caeb neṗl na Temṗach a ευaiɔ.

Raiṫ Colmain Mic Caelċon o Caṗn maceaṗaiɔi h-Ua Neill ṗaiṗ ευaiɔ .i. in[b] caṗn ευaiṗceṗeaċ.

Ceu Duma ino Luċhoumo i caeb Racha Colmain Mic Caelcon aniaṗ.

Ceu Colaiṫ [ocuṗ Diaɔlaiṫ[c]] i comaṗ-ouṗ Raṫa Colmain ṗaeṗeuaiɔ, .i. hi euoɓ na leiṫeaɔ a naiṗéuaiɔ ; .i. oi eiṗṗaiṫ ino ṗin, Colaiṫ inɔaṗaiɔi ocuṗ Diaɔlaiṫ aṗaiɔi, áṗ ni uil oeoċuṗ aeuṗṗu .i.[d]

Fothath Ratha Grainne is to the north of *Fan na Carbad*, near the northern *Claenfeart* to the east.

The two *Claenfearts* are to the west of *Rath Grainne*. It was in the southern *Claenfeart* that the virgins were slaughtered by the Lagenians on Saman's day, (1st of November). It is in the northern *Cleanfeart* that Lughaidh Mac Con pronounced the false sentence concerning the green field being eaten by the sheep.

The *Carn of the Leinster Youths* lies alongside the Sheskin of Temur to the north.

The *Cross of Fergus* the holy pilgrim, (who was in *Carraic Clumain,*) is alongside the *Carn of the Youths*, to the west.

Deiriol Teamhrach is between the two *Carns of the Youths*, i. e. between the southern *Carn* and the northern *Carn*.

The *Carn of the Hy-Niall Youths* is alongside *Deiriol na Teamhrach* to the north.

The *Rath of Colman, the son of Caelchu* is north-east of the *Carn of the Hy-Niall Youths* i. e. of the northern carn.

The *Mound of Luchdonn* is alongside the *Rath of Colman Mac Caelchon* to the west.

Adlaic and *Diadlaic* are in the vicinity of the *Rath of Colman*, to the north-east, i. e. in the side of the *Leiter*, (side of the hill,) to the north-east. These are two wells, the one called *Adlaic*, and the other *Diadlaic*, but there is no difference [separation ?] between them.

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[a] I ευαιο, i. e. in the vicinity of, as in H. 3. 3, which seems the true reading.

[b] Supplied from H. 3. 3.

[c] This passage is thus given in the Book of Glendalough : Is in Cloenfeṗeaiġ ευaiṗceṗeaiġ ευcaiɔ in mbṗeṫ in aġio Mic Con. Ġṗeċ i ṗuc Coṗmac imm an ġlaiṗṗin. i. e. In the northern Claenfert the sentence was given against Lughaidh Mac Con, that is, the sentence which Cormac passed concerning the green field.

[d] Thus given in the Book of Glendalough : Ceu eṗoṫ Fheṗġoṫa .i. noemaiṫeṫiṗ (ṫ he ṗil i Caṗṗaiċ Clumain) i caeb Caṗn na maceaṗaiɔi a n-oeṗ.

[a] O'n caṗn in the Book of Glendalough, *et recte.*

[b] Supplied from H. 3. 3, and Book of Glendalough.

[c] This passage is better given in the Book of Glendalough, thus : Ceu Colaiċ ocuṗ Diaɔlaiċ i comaṗ-

The text of the following poem is selected from the copy preserved in H. 3. 3 of the MS. Library of Trinity College, as no other copy so ancient, and, at the same time, so perfect, has been yet found. It has, however, been most carefully compared with the copies preserved in the Book of Ballymote, the *Leabhar Buidhe* of the Mac Firbises of Lecan, and the *Leabhar Gabhala* of the O'Clerys, in the Library of the Royal Irish Academy:

Cuan O'Lochain *cecinit.*	Cuan O'Lochain *cecinit:*
Temair tocca [tochta] na sulad,	Temur choice of hills,
Fo aca Eri inerrodd,[1]	Under which is Ireland warlike,
Airrdeacair Cormaic mic Airt,	[Was the] chief city of Cormac, son of Art,
Mic Cuinn Ceo cathaig comnairc.	Son of the puissant Conn of the hundred battles.
Cormac ba cunnuil[2] a maid,	Cormac—prudent was his goodness—
Ba raoi, ba fili, ba flaith,	Was a sage, was poet, was prince,
Ba fir breithiomh fer Feine,	Was true Brehon of the men of Feine;
Ba cairdi ba cocceilea.	Was friend, was companion.
Cormac ra clai caecao cad,	Cormac gained fifty battles,
Do filaid[3] Saltair Temrach,	He compiled the Psalter of Temur;
Ir in sgaltair fin aca,	In that Psalter is
Cin urr beach fuirm senchussa.	What is a good summary of history.
Ir fi in sgaltair fin ad beir,	It is that Psalter which gives
Seche n-airrichi Erenn inbir;	Seven monarchs of Erin of harbours;
Cuic ri na coicceo for gni,	Five kings of the provinces it makes,
Ri Erinn ira herri.	The King of Erin and her toparchs.
Ir innei aca oe cech leith	In it are [entered] reciprocally
Ina a n-dligh cech ri coiccid;	What each king of the provinces is entitled to;
Ina a n-dligh ri Temrach coir	What the King of Temur in the east is entitled to
Do righ cech cuicid ceolmoir.	From the king of each harmonious province.
Coimcenn comairmeras cach,	The chronology and synchronism of all,
Cech righ oe forle dorrach,	Of each king with each other completely,

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our Rath Colmain Mic Caelcon fair tuaith i taeb na leccrad fris in raid anair-tuaid .i. oi sirrdaic instin .i. Aolais inadanai ocus diadlaic atchi ada nad fil deirin etarru. i. e. *Adlaic* and *Diadlaic* are in the vicinity of *Rath-Colman Mac-Caelchon* to the north-east, on the side of the *Letter* (slope of the hill), and to the north-east of the fort. These are two wells, the one is called *Adlaic*, and the other *Diadlaic*, but there is no *difference* [?] between them.

[1] Inarradach.—*L. Ballymot.*, and *L. Buidhe Lecain.*

[2] Cunaal.—*L. Ballymot.* In more modern MSS., in which nn are used for nn, the word is written Connuill. Written cannuil in the *Leabhar Buidhe*, and *Leabhar Gabhala* of the O'Clerys.

[3] Nano Saltair Temrach.—*L. Ballymot., sed perperam:* Ro filaid Saltair Temrach.—*L. Buidhe Lecain.*

Cṛiochao ceċ coiccid ꝑo cṛuaiċ,[4]	The boundaries of each province from the hill,
Ota tṛoigid co tṛom tuaith.	From the *troigidh* to the heavy [large] *tuaith.*
Tṛicha aṛ tṛiochaio ceo noꝑ geib,	Thirty above a *Triocha ched* [barony] it finds
Do tṛichuib ceo ceċ cuiccid.	Of *Triocha cheds* in each province.
In ceċ cuiceó oib ata	In each province of them are
Seċt pṛimꝑiċie pṛimoingna.	Seven full score of chief fortresses.
Roꝑ ꝑiteiṛ Coṛmac ꝑa ṛi,	It is known, that Cormac, the king,
Ro la cuaiṛt Eiṛenn ꝑo thṛi,	Made a visitation of Erin thrice;
Tuc giall ceċa muiṛ amuiċc,	He brought the hostage of every fortress out,
Co ṛoꝑ taiṛealu[5] a Temṛuiġ.	And exhibited them at Temur.
Duma na n-Giall[6] gloine n-glac,	The *Mound of the Hostages* of fair hands
Dona giallaib tuc Coṛmac,	To the Hostages Cormac gave;
Do Coṛmac taṛꝑaꝑ na toiċc,	To Cormac was shown[7] in his house
Ceċ decaiṛ ata a Temṛoiġ.	Every *decair*, which is at Temur.
Roꝑ taṛꝑaꝑ d'Feṛguꝑ muṛta,[8]	To Fergus was shewn in a vision
Aiṫ a ꝑuil Cṛoꝑ Feṛġuꝑꝑa,	The place where is [stands] the *Cross of Fergus,*[9]
Fan na caṛpuṫ con ceṛta,[10]	*Fan na carput* is exactly
Etoṛṛau ꝑaun Claoinꝑeṛto.[11]	Between them and the *Claenferts.*
Claoinꝑeṛto a n-gaoldaoiꝑ aindṛi,	The *Claenferts* in which the girls were slaughtered,
Claoinꝑeṛta na claon caingni,	—The *Claenferts* of the treacherous covenant—
O Raiṫ Gṛainne aniep anoiꝑ[12]	From *Rath Grainne* down to the west
Ataid cen eṛċṛu anaon oiꝑ.[13]	They are, without obscurity,[14] both.
O Raiṫ Gṛainde ꝑaiṛ ꝑan glinn,	From *Rath Grainne*, east in the glen,

[4] Cṛichaó gach coigid o ċṛuaiċ, O ta tṛaigid, &c.—*L. Ballymot.* Cṛiochaó cech Coiccid ꝑo cṛuaich.—*Leabhar Gabhala* of the O'Clerys. O'Flaherty understands *traigidh* or *troigidh* as meaning the smallest subdivision of land in use among the Irish.

[5] Taiṛealb.—*L. Ballymot.*, and *L. Gabhala* of the O'Clerys.

[6] Omitted in *L. Ballymot.*, but given in the *L. Buidhe*, and *L. Gabhala* of the O'Clerys.

[7] This alludes to a tradition among the Irish, that King Cormac foresaw in his house of meditation every building and other feature that would be on the hill of Tara in after ages. For an account of Cormac's house of meditation, see the Book of Lismore, in the Library of the Royal Irish Academy.

[8] Taṛꝑaꝑ d'Feṛguꝑ baile ita.—*L. Ballymot.*

[9] This refers to another Irish tradition, that Fergus, the pilgrim of *Carraic Clumain*, saw in a vision that a cross would be erected in honour of himself near *Fan na Carput*, on the Hill of Tara.

[10] Conceṛcca.—*L. Ballymot.* Conceṛta.—*L. Buidhe* of Lecan, and *L. Gabhala.*

[11] Etuṛṛu iꝑ na Claenꝑeṛta.—*L. Ballymot.*, and *L. Gabhala.*

[12] Fṛi Raiṫ n-Gṛainoi aniaṛ aniꝑ.—*L. Ballymot.* O Raiṫ Gṛainne aniaṛ aniꝑ.—*L. Buidhe*, and *L. Gabhala.*

[13] Atat gan uṛcṛa n-aonmiꝑ.—*L. Ballymot.* Atat cen eṛcṛa n-ainbiꝑ.—*Leabhar Buidhe.* Atat cen eṛcṛa an oeinoiꝑ.—*L. Gabhala.*

[14] i. e. They are both conspicuous.

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Aṫa Seṡcṁe Temṙaiḋ ṡiṁa ;
Aṫa ṙṁ ṙeṙcṁa aṁoiṙ [uṁaiṙ]
Raiṫ Neṙṙa, Raiṫ Conċobaiṙ,
Copuṙ Ciṁa Conculoiṁa ṙṁaiṫ,
O Raiṫ Conċobaiṙ ṙuiṙeaiḋ,
Toṁaṙ a ṡeeṙ ṙo Cobṙaiḋ[11]
Iṙ iṅṡniuṁ, iṙ iṁaobal.[12]
Ḋṫge Maiḋ ocuṙ Miḋna
Aṫ o-Teaṁṙaiġ, iaṙ na eiṁ,
Oe aṡa aiṫiġiu ṙa Leaċe,
Daṫġ in ciṁa ṙo coṁṁaiḋeaċe.[13]
Iṁṙaiṁ ṙoṙ Loiṫg naiḷḷaiṡeċ,[14]
Ḟṙiṙ a n-aḃaṙ baṙṙ baṁ mbaeṡ ;
Teċ na baeṡ niṙ bo loṁṡe baee[15]—
Co ceiṫṙi ooṙṙṙiḃ oeaċ.
Duṁa na mban, iaṙ na mbṙaiṫ,
Ḟoṙ ano mneḷḷ uaṡeaṙaiṫ ;[16]
Doḷḷ iṙ Doṙṡai ḟṙiṙ a n-oeṙ,
Ro ṙṁeṁeḃa ṙṁ coṁuiṫṡeuṙ.
Duḷḷ eeṙ, eiaṙ Doṙca ooṙṙa,
Ba ḃiḃ Duṁa Doḷḷ ḃooṙai ;
Ro maṙḃ ceéeuṙ aṙaile,
Ṁ coṙṁaiṁ a n-aḷṁṙuiṁe.[17]
Bo luiṁ an e-abaċ—ṙuaṫ bo !
Bo eeoṙṫuiṙ eooṙṙa,[18]
Co ṙo maṙḃṫuiṙ in e-abaċ
Ḟo a ecoṙaiḃ, ġeṙ ċlaeṁ aṁaṙċ.[19]
O leċeuṙ an abaiṡ ṙṁ ṙiaṙ,[20]

Is the *Sheskin* of strong *Temur* ;
To the east of the *Sheskin* are
The *Rath of Ness*, the *Rath of Conchobhar*.
The *Corus Ciun of Cuchulainn* the hardy,
From the *Rath of Conchobhar* north-east,
The measure of his *Shield* under *Cubhradh*,
Is wonderful, is prodigious.
The Grave of Mal and Midhna
At Temur, after their deaths,
Hence are their grave and monument,
In consequence of the head which they exhibited.
Let us mention also *The Lung of the Heroes*,
Which is called the *Barc of the* vain *Women* ;
The *House of the Heroes* was not a weak house—
With fourteen doors.
The *Mound of the Women*, after being betrayed,
At the upper extremity ;
Dall and *Dorcha* to the south of it,
Who were killed by their competition.
Dall east, eiar Dorca ooġra,
Dall south, the sorrowful *Dorcha* west,
Of them is the *Mound of Dall Bodhra* ;
Each of these killed the other,
Fighting for their alms.
The dwarf went—pity of him !
To interpose between them,
So thatthey killed the dwarf
Under their feet, though a piteous sight !
From the monument of that dwarf west,

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[11] Ro a cubṙaiḋ, that is, under his *Cubradh*.—*L. Ballymot.* Fo cobṙaiḋ.—*L. Gabhala.*

[12] Iṙ iṅṡniuṁ, iṙ iṁaobal.—*L. Ballymot.*

[13] Daṫġ an ciṁa ṙo coṁṁaiḋeaċ.—*L. Gabhala.* Aiṫe an ciṁa ṙo coṁṁaiḋeaḋ.—*L. Buidhe Lecain.* The change in the text was made for the sake of rhyme.

[14] Luiṫg na Laeċ.—*L. Ballymot.*

[15] Teċ na ṙiaṁ ni long laiġ.—*L. Ballymot.*

[16] Aṙ a oċaiṁ uaṡeaṙaiṡ.—*L. Ballymot.*

[17] Ic coṙṁaiṁ a n-aḷṁṙuiṁ.—*L. Ballymot.*

[18] Bo euaṙġuiṁ eeoṙṙa.—*L. Ballymot.* Deoġaiṙe —*L. Buidhe.*

[19] Iaṙ ṙṁ-aṁaṙċ.—*L. Ballymot.*

[20] O leċe in abuiṡ ṙiṁ ṙiaṙ.—*L. Ballymot.*, and *L. Buidhe.*

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Maol, Bloc, Bluicni, bopb a ciall,	*Mael, Bloc, Bluicni,* [druids] of powerful sense,
Fopéai hi taie na tpi cloća[61]	On them are the *three stones*
Dup paplaic Mal mop Maćai.	Which the great Mal of Macha cast.
Mup cleiéi na tpi cocap,	The *Mur of the concealment of the three conspiracies,*
Itip Luing ip Laoć topap ;	Between the *Long* and the *Heroes' Well ;*
Lia na Fian fpi fligé inaip,	*Lia na Fian* to the east of the road,
Ap inchaib Ratho Senaig ;	Opposite the *Rath of the Synods ;*
Raiť Senaiб pegoa ceć mbuaio,	The *Rath of the Synods* of great virtues,
Fpi Fal na Tempać ceuaio ;	To the north of the *Fal* of Temur ;
On paiť paip aeaob an liag,[62]	East of the Rath by the side of *the Stones,*
An teć ap tepno Bniao.	The house out of which Benignus escaped.
Senaб Paepaic o'n paiť pain ;[63]	The synod of Patrick [was held] in this great Rath ;
Senaб Bpenainn ip Ruaбain ;	The synod of Brendan and of Ruadhan ;
Senaб Adamnain iap fin,	The synod of Adamnan afterwards,
Ac epcaine Ipgailig.[64]	In cursing Irgalach.
O Raiť na Rig paip [*recte* piap], ni go,	From *Rath na Righ* east, [*recte* west,] no falsehood.
Lećt Con, Lecht Cethen, Cnoc bo,	*Lecht Con, Lecht Cethen, Cnoc bo,*
hi ea fpip fin paieh anaip[65]	Of this *Rath* eastward is
Lećt Maine Mic Munpemaip.	The *Lecht of Maine son of Munremhar.*
Maipio fpi Raiť Rig hi n-oep	South of *Rath Righ* remain
Raieh Laegaipi ip a Lep,	The *Rath of Laoghaire* and his *Lis,*
Ip a Lećtup fop lap a Lip,[66]	And his *Lecht* in the middle of his *Lis,*
Fipen piaбaiс po fopbpipp.	Which an upright witness partly broke.
Fegaio Teć Muipigpi m-benn,[67]	Behold the *House of Muirisc* the famous,
Ppimaiei aile Eipeann,	[Who was] the chief beauty of Erin,
Apo aniap, ipapo an euaio,	High at the west, very high at the north,
Ipiul uaiб paip, ba paep buaiб.[68]	Low to the east, sign of prosperity.
Ip ann po fuioigeб fe	The place in which was situated

[61] Foppu a tao na tpi cloća.—*L. Ballymot.*

[62] Uaiui paip i taeb ino liacc, in teać a tepno Beniat.—*L. Ballymot.* O Raiť paip a taeb na liag, An tech ap tepnao Beniao.—*L. Buidhe.*

[63] 'Con paiť pain.—*L. Ballymot.*

[64] Ag epgaine Iopgalaig.—*L. Buidhe, et recte.*

[65] Aea fpip in paiť anaip.—*L. Ballymot. et recte.* A naippehep na paťa paip ita.—*L. Buidhe.*

[66] Ip a lećt fop lap a lip.—*L. Ballymot.*

[67] Fegaio Teć Maipipe meann.—*L. Ballymot.*

[68] Ipel uaiť paip ba paimbuaiб.—*L. Ballymot.*

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An teach ar bru Nemnaiġe ;[13]	The house is on the brink of *Neamhnach;*
Mon teċ rin, tar Mide amach,	About this house, out over Meath,
Ro ruleu tiġe Temruċ.[14]	The houses of Temur are spread.
Temair, dieu Temair Breaġ,	The Temur, from which is Temur of Bregia,
Mur Tea, mna mic Mileaḋ,	Was the *Mur* of Tea, the wife of the son of Milè,
Nemnach uad rair rruċ fo glenn,	*Neamhnach* from it east [pours] a stream into the glen,
Ferr tarb Cormac ceo muilenn.	On which Cormac placed the first mill.
Ciarnaid, cumal Cormaic ċoir	Ciarnaid, the bondmaid of the just Cormac,
Ceo no biaṫaḋ a broin,[15]	By whose quern a hundred were fed,
Deċ meiċ le ceċ lai do bleiċ,	Was used to grind ten *miachs* each day,
Nir obair duine deinmeich.	Not work for a vain person.
Rof tarraḋ aicce in ri ran	The noble king took her to him
In a tiġ a h-aonuran,	Into his house alone,
Cor fo toirrcerair fo ċleiċ,	So that he secretly made her pregnant,
Ier rin ro eimiġh ro bleich.	After which she refused to grind.
Cormac, ro cluinim, ua Cuinn,[16]	Cormac, I hear, the grandson of Con,
Tuġ raor muilinn tar mor tuinn,	Brought a millwright over the great sea,
Ceo muilenn Cormaic Mic Airt,	[Who erected] the first mill of Cormac Mac Art,
Ro bo cobair do Ciarnaiṫ.	Which was of assistance to Ciarnaid.
Caprać Cormaic a Raiṫ Riġ,	*Caprach Cormaic* at *Rath Righ,*
O Raiṫ Riġ rair, ir e a ṡir,	From *Rath Righ* east, it is the truth,
Aṫa in eorur tuirme clann,[17]	Is the well of *Tuirme Clann,*
Frir a n-abar tri h-anmann,	Which is called three names,
Liaġ dael dubh, Duirbh Tuaṫlinne,	*Liag dael dubh, Duirbh Tuathlinne,*
Ocur Tipra Bo Finne :	And *Tipra Bo Finne :*
Tri hanmanna ren rlomter imaċ,[18]	These three names are called out,
Do rilad cobair Temrach.	To produce the wells of Temur.
Tobar aile adbal erer	Another well of great strength
A Temraiġ rileṙ rarderr,—	Flows south-west of Temur,—
Laeġ a ainm, ġen co oin bu,	*Calf* is its name, though not the young of cow :
Cuċtair Cormaic for a bru.	*Cuchtair Cormaic* [is] on its brink.

[13] Thuaid for bru Neamnaidhe.—*L. Buidhe.*

[14] Ro rileu tiġe Temrach.—*L. Ballymot.*

[15] Mor ċeo no biaṫaḋ a broin.—*L. Ballymot., recte.*

[16] Iar rin ror oirċir ua Cuinn.—*L. Ballymot., recte,* and *Gloss on this poem* in *H.* 2. 17.

[17] Co a ta in cobar eruimi clann.—*L. Ballymot.* Muirne clann.—*Copy in H.* 2. 15. *p.* 232.

[18] Tri h-anmann dia rloind imaċ.—*L. Ballymot.*

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Bruinnid a Temraig aneuaid,
Adluic Diadluic an c-sluaig,
Da tobar, fo deodain de,[39]
Sir co Carn na macraidhe.
Eter da carn na n-gilla
Deisiul Temrach, ter crinnae,[40]
Fos co rae ria n-dul ar ceul,
A roidoir daine deiseal.[41]
A cuaid frir in eulaig cruim
Rath Colmain, in Domnann duinn;

Lecht Caelcon, fo cochma cloc,
Sainceuaid o Long ban Temrach.[42]
Caelcu, mac Loairn, mic Ruaid,
Mic Cormaic Cais, berid buaid,
Primgiall fer Muman amach,
O daig suidig Suil Temrach.

Ted Temrach imb aca in rath,
Ar rabsad olcheb di cach,
Marsid for crocce cia ramlaid,
Ac riccaib, ac rigdamnaib.
Ri ocus ollam filid,
Sai, bruccaid, berair dliccid,
Lebraid na loircéi loichet,
Laaire ocus longdoicheaire.
Liaic, ir baitlum, goba gur,
Recheuiri, randuiri run,
Maoil na ceéra doib uili,
A roicc ano rich barrbuidhe.
Rinduis, raitbuigi rel,
Sciaccairi, ir rianuidi reig,
A teig rig do ibeir corm,
Da he a n-dligeb dilis dorn.

In Temur, at the north spring,
Adluic [and] *Diadluic* of the host,
Two wells, no separation between them,
[Flow] down to *Carn na macraidhe*.
Between the two *carns* of the youths
Is *Deisiul Teamhrach*, south of Crinna,
A sod with luck before going to heaven,
Where men turned to the right.
North of the mighty hill
Is the *Rath of Colman*, the brown-haired Domnan;

The *Lecht of Caelchu*, a heap of stones,
North-east of *Long ban Teamhrach*.
Caelchu, the son of Loarn, son of Ruadh,
Son of Cormac Cas, who gained the victory,
The chief hostage of the men of Munster,
From whom are [descended] the chiefs of *Ros Teamhrach*.

The house of Temur around which is the Rath,
Whence law was distributed to all,
There exist still people like them,
With kings, [and] with Roydamnas.
King and Ollave poet,
Sage, Brooee, who distributed law,
[Had] beds which lightning did not burn,
[And] the *laare* and *lonchroicheat*.
Physician, and cup-bearer, stout smith,
Lawgiver, lusty butler,
The *maoil* of the cattle to them all,
In the house of the yellow-haired king.
Engraver, and skilful Rath-builder,
Shield-maker, and vigorous soldier,
In the king's house used to drink beer,
It was their lawful privilege.

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[39] Fo decair de.—*Copy in H. 2. 15, p. 232.*

[40] Ter crinna.—*H. 2. 15.*

[41] A ruidoir daine ar deisel.—*H. 2. 15.*

[42] The four quatrains from tobar aile crobal crer down to this line, both lines inclusive, are omitted in the Book of Ballymote, most probably through inadvertency of the transcriber, as the wells and the Rath, described in these quatrains, are mentioned in the prose account of the remains at Tara, prefixed to the poem in that book.

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Dhai, fiocellaiġ, fuirpeoir faon,	Druid, chess-players, and arch-buffoon,
Cuirtenoaiġ, cleraiġi claon,	Pipers, and tricky jugglers,
Colpas a cuit feola, ier fir,	The *Colptha* for their share of meat, in truth,
In can eiugas i teć righ.	When they come into the king's house.
Rigteć cuit fenmoiri faor,	The *Rightheach* the share of the noble preacher,
Cairteoir ir cerda marsan.	Of the Cashel-builder and artisan likewise.
Cornoiri, buinoire arbuiġ,	The cupbearer, and vigorous footman,
Deiri ro meloir mid mer.	Both drank cheering metheglin.
Muiniuin do mal Miri.	The *muiridin* to the chief of Meath.
Camiomhoin, ir ciorṁuiriu,	The embroiderers, and fullers,
Dlieid do n dhoinne fhebuir fhein,	Are entitled, as a people skilful, important,
Icheor femor in fhlinnein.	To the fleshy lower part of the shoulder.
Dromanna dhonna in teć fheb,	The straight backs in every tribe,
Do druiniḃ, do doirpeoraiḃ.	To druids, and doorkeepers.
Uasdlae daingein cenaċ,	What fortress will be protected,
Ier n-imorai tiġi Temraċ?[a]	After the suppression of the house of Temur?
Colum Cilli, chenuid broin,	Columbkille, who purchased hostages,
Do rad an caṫ do Diarmaid,	Gave the battle to Diarmaid,
Re n-oula do ar muir amaċ,[a]	Before his going over across the sea,
Do giallrad duib na Temraċ.[a]	The chiefs of Temur gave him hostages.
Chetoim Chriṫe ro ċer a chri,	The faith of Christ tormented his heart,
Do ċuir teć nerc for nemoni,[a]	He brought all strength to nought,
Ar brón do toam De na toiġ;	In consequence of the sorrow of the people of God in his house;
Ni fhuc fermonn do Temroiġ.	He extended no protection to Temur.

Taking the preceding ancient documents as a guide, the remains on the Hill have been identified with the descriptions given of them, in the following order:

1. The Well *Neamhnach*. This is marked in the poem as lying east of the *Mur Tea*, which is within the principal rath of Tara; and more accurately in the prose tract, as north-east, and supplying the stream on which the first mill was

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[a] The preceding eight quatrains are omitted in the Book of Ballymote, that is, from Tech Temraċ imb ṫeċ in raiṫ, down to Ier n-imorai tiġi Temraiṫ, both lines inclusive, but they are given in the *Leabhar Buidhe*, and in the *Leabhar Gabhala* of the O'Clerys. The verses following seem to be the production of a later writer, as they are not found in the *Leabhar Buidhe Lecain*, and other ancient vellum MSS.

[a] Re n-oul do dar muir imaċ.—*L. Ballymot., recte.*

[a] Ron giallraḋar duib Temraċ.—*L. Ballymot.*

[a] Ro ċuir caṫ nerc ar nemheni.—*L. Ballymot.*

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erected in Ireland. This well was at once identified, as it is the source of a stream which has turned a mill on the site of the ancient one to the present day.

2. The next grand feature identified was *Rath na Riogh*, the most important enclosure on the Hill, which is clearly pointed out by its locality in relation to the Well *Neamhnach*.

3. These two points being ascertained, no doubt remained of the situation of *Rath-Laoghaire*, which was situated immediately south of *Rath na Riogh*.

Having ascertained beyond question these three grand features, the smaller monuments within the enclosure of *Rath na Riogh* were at once identified. These are described in the prose only, and are as follows :

4. *The ruins of the House of Cormac*, in the south-east of the Rath, facing *Rath-Laoghaire*, which is to the south.

5. *The ruins of the Forradh*, beside the House of Cormac, which is to the east.

6. *Tea-Mur*, the ruins of which were, according to the prose, as given in the Book of Glendalough, situated between the *mur* of the *Forradh* and the House of Cormac.

7. *The Mound of the Hostages*, which, according to the prose, lies to the north-east of the ruins of the *Forradh*.

8. *The Mound of Glas Teamhrach*, which, according to the prose, lies to the west of the Mound of the Hostages.

9. The *Lia-Fail*, which lies by the side of the Mound of the Hostages.

10. *The Rath of the Synods* was the monument next clearly identified. This, according to both the verse and prose, was situated immediately to the north of the *Lia-Fail* and the Mound of the Hostages, and within it were the remains of *Adamnan's Pavilion*.

11. *The Cross of Adamnan*, which, according to the prose, was situated to the east of this rath, is found in the situation pointed out, but in a mutilated state.

12 and 13. South of these was the *Mound of Adamnan ;* but this, as well as the *House of Mariseo*, to the north of the Well *Neamhnach*, have long been destroyed, and their site occupied by the church dedicated to St. Patrick, and erected since the time of the writers of these ancient documents.

14. However clearly the preceding remains were identified, they were less distinctly pointed out than the next grand monument now to be noticed—namely,

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the *Teach Miodhchuarta*, or banqueting house, which is described with a remarkable accuracy as an oblong structure, having its lower end to the north, and higher end to the south, with walls to the east and west. In these walls, according to the prose account, there were twelve or fourteen doors, six or seven on each side ; and it is a curious fact, that there is a difficulty in ascertaining, at the present moment, whether the number was twelve or fourteen.

15. The next important feature is the *Sheskin*, or Marsh, of Tara, which is described as lying to the north-west of *Teach Miodhchuarta*. This spot, though now dry, was a marsh, within the memory of some of the present inhabitants, one of whom, by stopping the well and cutting a drain below it, has changed its ancient character. The ancient name of the well is, however, still preserved, namely, *Tobar-Finn*. This feature being ascertained, the few which remain were at once identified.

16. *Rath Graine*, which, according to the verse and prose, lies west of the *Sheskin*, on the height of the Hill.

17. *Fothath Ratha Graine*, which, according to the same authorities, lies to the south of the preceding.

18. The *Rath of Caelchu*, which, according to the prose, was near the northern head of *Long na m-ban*.

19 and 20. And lastly, the two *Claenferts*, or declivities. Of these the northern was memorable in Irish history for the slaughter of the virgins by the Lagenians on Saman's day ; and the southern, for a false sentence pronounced there by a king named Lughaidh Mac Con, for which he was afterwards dethroned.

The remaining important features noticed in these ancient tracts, many of which they describe as being even then nearly effaced, are now totally destroyed.

It will have been seen that the veracity of these ancient documents has thus been proved, beyond the possibility of rational doubt, by many of the principal monuments which they describe, and which still remain. And from this light the names of these monuments, which had been lost to tradition for centuries, have been restored on the Ordnance Map, where they are likely to be preserved for ever.

The monuments still existing on the hill of Tara being thus identified from ancient authorities, the next important point is to ascertain the various eras of their origin, as far as they can be determined from historic evidences in con-

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nexion with their ancient names. But, to make this inquiry satisfactorily, it will be necessary to extend it to the monuments now wholly destroyed, as well as to those of which there are still vestiges remaining.

The monument of first importance, both as to size and antiquity of construction, seems unquestionably to be the great Rath, or enclosure, marked in the descriptions by the name of *Rath na Riogh*, or the Rath, or Fortress of the Kings. This great enclosure seems to have been formed of two *murs*, or parapets, having a ditch between them, as described in the prose account. The great or external diameter, taken north-west and south-east, is 853 f., the interior 775. It encircled the southern brow of the hill; the northern side being on its top, and the eastern, southern, and western, on its slopes. The rings have been in most parts removed; and, it is to be regretted that, the proprietor is yearly removing more of them to spread on his land. A portion of the outer ring still remaining is $2\frac{1}{2}$ f. above the natural hill; and the ditch, or bottom, is 4 f. below it, so that from the bottom of the ditch to the top of the outer ring is $6\frac{1}{2}$ f.

Independently of the superior importance, as to extent, of this great enclosure, its situation on the apex of the hill is a strong evidence in favour of its priority of origin to all the other remains. There is, however, in addition to these circumstances, the corroborative testimony of the poem of Cuan O'Lochain, in which the *Tea-mur* appears to be clearly identified with the *Rath na Riogh*; and, though the prose description makes the *Tea-mur* only a feature within this enclosure, this notice must, and does obviously, only apply to the sepulchre, or monumental mound, to which bardic tradition had given that name. Indeed, as already observed, the legendary existence of the Spanish queen Tea, as a portion of the Milesian story, must be left out of consideration in sober investigations, till the truth of that national tradition be placed on a more solid foundation. From the preceding documents it will have been seen that, as early as the ninth century, this derivation of the name of *Teamhuir* from the Milesian queen, was doubted by the learned Cormac Mac Cullenan; who, in his valuable etymological vocabulary, substitutes, as a more probable conjecture, a derivation from the Greek, (*θεωρεω*,) "because," as he adds, "the Scots [meaning the Irish] have a saying in common use, *Teamuir na tuaithe agus Teamuir an toighe*," that is literally, "Teamuir of the country, and Teamuir of the house;" of which appellations he says, the former signifies a hill, and the latter a *grianan*,

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MONUMENTS OF PAPAL HILL PICTURED FROM ANCIENT DOCUMENTS

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or palace, and hence he conjectures, that *Teamhuir* simply means any conspicuous place. The same etymology is given in the Latin language in all the copies of the *Dinnseanchus*.

Cuan O'Lochain also, though he repeats the legend of the origin of the name *Tea-mur* from queen Tea, asserts that *Teamhuir* signifies any flat-topped hill on which there is a fortified residence. This mode of accounting by fabulous personifications for ancient names of places—as Britain from Brute, Scotia from Scota, Denmark from Dan, Rome from Romulus, Brabant from Brabo, France from Franeus—has been a general practice among all ancient nations; and seeing that, in the present instance, the probability of such a derivation was more than doubted by the learned among the ancient Irish themselves, it would be extremely puerile now to consider it as of any value. Indeed, the probability is much stronger that the Milesian queen owes her name and even her very existence to Temur than Temur its to her. Nor would it be difficult to adduce many evidences to support this hypothesis, if this were the place to do so. But, though such would necessarily lead to an inquiry inconsistent with the limits of this memoir, namely, the origin and age of the Scotic or Milesian colony in Ireland, a few remarks will not be inconsistent with its present object. Those who are familiar with the learned and ingenious arguments of Innes, in support of his hypothesis that the Scots were a northern or Teutonic colony, who could not have come into Ireland much sooner than the first century, will be surprised to find in the references in the ancient poem of O'Lochain, and the prose prefixed to it, given among these documents, evidences which would support this hypothesis, and thus settle the long disputed era and origin of the Milesian colony. According to these authorities, the supposed queen Tea, the daughter of Lughaidh Mac Ith, who was the uncle of Milesius, was also the wife both of Heremon and of Gede Ollgothach. It would appear, however, from Irish history, that Gede and Heremon were only different names for the one person, or at least, that the names of three of their children were the same. Now it is a singular fact, that the Pictish authorities make this Gede the eighth of the Pictish kings, and the son of Cruithne, or Cathluan, who was the progenitor of the Picts, as the Irish make Heremon the son of Milesius, who was the progenitor of the Scots. But the Irish authorities make Gede also king of the Irish and Scottish Picts, but the son of Ollamh Fodhla. For example:—

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Ollam Fodla dno .e. mic Lair .i. Cairbre, Finnachta, Slanoll, ocus Gede Ollgothach; ocus Labraid, dia eat rigraid Ulad .i. Clann Labradra.

Ollamh Fodhla had five sons, namely, Cairbre, Finnachta, Slanoll, and Gede Ollgothach; and Labhraidh, from whom are the Kings of Ulster, namely, the Clann Labhradha.

Book of Lecan, fol. 138, *b*, 2.

Again: Ollamh Fodhla, according to the corrected chronology of O'Flaherty, would have flourished about 500 years before Christ, while according to the Pictish list of kings, Gede could not have reigned earlier than the first century; and yet all the Irish authorities acknowledge not only that the Pictish list of kings is correct, but also that the arrival of the Picts was cotemporaneous with that of the Scots, and that their wives were Scots. But, as already remarked, this is not the place to follow up an inquiry of such magnitude and importance; and it has only been touched on here, for the purpose of showing how necessary is a thorough investigation of all the MS. authorities still existing in Ireland to the final settlement of the ancient history of the British Isles. The Bardic etymology of the name *Tea-mur* may, at all events, be very well rejected as legendary; nor is it necessary to adopt the mere conjecture of Cormac and other ancient writers respecting its Greek derivation, as a more probable origin of the name appears to be found in the Irish words, *teach*, a house, and *mur*, a wall—*Teach-mur*, house of the walls, or enclosures, for defence; a name particularly applicable to the place. As it is obvious, then, that *Tea-mur* and *Rath na Riogh* are but different and equally appropriate names of the same fortified regal habitation, there can be no rational doubt of the priority of origin to be assigned to this work above all the others circumjacent to it. But, though its great antiquity is thus established, it would be a useless labour to endeavour to assign a period to the foundation of a work erected so long anterior to the dawn of chronological history. That it was considered by the Irish as of the most remote age is clear from their historical tradition, which assigns its first erection to the Fir-Bolg and the Tuatha De Danann colonies, the predecessors of the Milesians, or Scots, and by the latter of whom it was called *Cathair Crofinn*, a name explained by the bards, as signifying the city of Crofinn, a Tuatha De Danann queen, but the most obvious interpretation of which appears to be—the circular stone fortification of the fair house or enclosure. It may, indeed, be objected to the truth of this historical tradition, and to the interpretation here given of the name, that no remains of a *Cathair*,—a term never applied by the Irish to

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any but a circular stone fortification, without cement,—are now to be found on the hill: but a negative objection of this kind should have but little weight, in reference to a monument so long subjected to every destructive influence; and if it were allowed, it would equally apply to all the stone monuments described as existing on the hill in the twelfth century, and of which but a few vestiges can now be found. It is obvious, moreover, that the absence of stones from the hill, if such were the fact, might be sufficiently accounted for by the assumption, that they were used in the erection of the old church and the wall of the cemetery, as well as of the houses of the adjacent village. It is not the fact, however, that no stones are found on the hill. They are found in considerable quantity in the very situation in which they should be looked for, as remains of the ancient *Cathair*, namely, forming a portion of a wall of the enclosed ring of *Rath na Riogh*. This wall occupies about the fifth part of the whole circle, and is composed of stones well adapted to the purpose of building; the remaining part of the enclosure being nearly levelled with the ground. For their preservation in this portion of the circle a sufficient cause is found in the circumstance, that they serve to mark the mearing of two townlands; and, though it might be conjectured that they were originally brought thither for this purpose, the objection is met by the fact, that as soon as the boundary diverges from the circle of the fort it is wholly formed of earth, and that no other ditch or mound on the hill is formed of stones. The assumption, therefore, that these stones are not of ancient existence on the spot, has no foundation even in probability; and it is only a rational inference that these are a portion of the material of the ancient *Cathair Crofinn*. In ancient Irish poems, this fortification is sometimes called ꞇuꞃ ꞇꞃen Ꞇeṁꞃaċ, the strong *tower* of Temuir, an appellation never applied to a *Rath*, but constantly to a *Cathair*, or circular stone fort; and Mac Firbis has preserved from an ancient authority the name of its artificer, "Troylane, who cut figures, (Ꞇꞃoiġleaꞇan, a ȯluiȝ ɒealḃa)."

In the prose description the monuments next noticed are those situated within the external rings of *Rath na Riogh*. There are, according to this account, three *decras*, or, as it is better stated in the copy in the Book of Glendalough, three *decra inganta*, or wonderful monuments, within this Rath:

1. The *Ruins of the House of Cormac* in the south-east of the Rath, facing *Rath Laoghaire*, which is to the south.

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2. The *Ruins of the Forradh*, which were alongside the ruins of the House of Cormac, and to the west.

3. The *Mur-Tea*, or wall of *Tea*, which was between the two preceding monuments, and on the south side.

There are, in addition to these, three other monuments within the inclosures of *Rath na Riogh*, whose situation is described with equal accuracy, namely:

1. *Dumha na Bo*, or the Mound of the Cow, which is described as being situated to the west of the *Dumha*, or Mound of the Hostages.

2. *Dumha na n-Giall*, or the Mound of the Hostages, which is described as being situated to the north-east of the ruins of the *Forradh*.

3. *Fal*, or the *Lia Fail*, which is described as lying by, or at the side of, the Mound of the Hostages, to the north.

Of these remains, the only one whose age can be conjectured from historical evidences connected with its name is the House of Cormac. Supposing it to have been erected no earlier than the time of the monarch after whom it was called, it must be assigned to the period between the year 218, when he mounted the Irish throne, and 254, when he abdicated it in favour of his son.

The House of Cormac is a Rath, with an outer ring, having a ditch between the inner and outer inclosure. The measurements of this Rath will be seen in the accompanying section taken north-west and south-east, on a scale of 60 f. to an inch:

The parapet at *a*, on the north-west side, is 1 f. 1 in. higher than at *b* on the south-west; and is 2 f. higher than the interior of the Rath: the parapet at *b*, on the south-east side, is also 2 f. higher than the interior of the Rath.

Of the other monuments, described as situated within the *Rath na Riogh*, that called the *Forradh* seems to be the first in importance. This, as already shewn, is evidently the rath described as situated to the north-west of the house of Cormac, and which is connected with it.

This monument is a Rath very similar in appearance to the House of Cormac,

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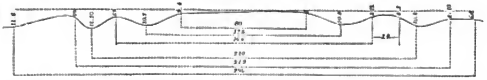
but having two outer circles, with ditches between them. The parapet of the mound itself is now levelled. The measurements will be seen in the sections here given, which are on the same scale as the preceding. The first section is from north-west to south-east,

From the second section, which is from south to north, it will be seen, that the mounds are not quite circular:



The connections of this Rath with that called the House of Cormac will appear from the section following, which shows how the two monuments are united by a common parapet, or circle, at *a*. This section, which is taken north-west and south-east, is on a scale of 90 f. to an inch.

For determining the age of the *Forradh*, no distinct historical evidence has hitherto been discovered. The general similarity of its construction might, indeed, very fairly lead to the conclusion, that it is coeval with the House of Cormac with which it is connected, and such is most probably the fact. There are, however, many reasons, from which it might be inferred to be of prior origin; as, first, that it occupies the usual central position within the outer circumvallations which indicates its original and coeval erection with them; secondly, that it is a more important monument as to size, than the House of Cormac, and that its form is more regular, the latter exhibiting an irregularity apparently the effect of its adaptation to that of the earlier and more symmetrical work. It might also be urged from the ancient poem attributed to Fintan, given above, that the

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name of this monument, *Forradh*, was applied even to the palace of Tara itself, from its earliest occupation by the Scotic or Milesian kings, so that it might with every probability be regarded as the earliest of the monuments now remaining there. The meaning of its name would also seem to support this conclusion, as it is properly explained by Colgan, *Trias Thaum.*, p. 141, col. *b*, to signify a place of public meeting, like the *Tings* of the Orkneys and of the Isle of Man. It also signifies a judgment seat, a bench, and is probably cognate with the Latin word *forum*, or perhaps the Icelandic *for-rad*, Lat. *vis*, *dispensatio*. At all events, its erection cannot be ascribed to a later period than the other, and an interesting illustration of its antiquity and use appears to be found in the following passage from the *Konungs-skuggsio*, or Royal Mirror, *Antiq. Celto-Scand.* p. 289 :

"*Enn þar sem hæd þótti borgarinnar vera, þa átti Kongurinn þar kastala fagrann ok vel georfann, í þeim kastala átti hann fagra haull ok mikla, ok í þeirri haull var hann vanur at sitia yfir dómum manna.*"

"In editiore quopiam civitatis loco splendidum et tantum non Dædaleum castellum Rex, et intra castelli septa palatium structum et nitore superbum habuit, ubi solebat litibus incolarum componendis præesse."

But as the preceding translation is rather overstrained, a more literal one in English is here added :—"And in what was considered the highest point of the city [*Themar*] the king had a fair and well-built castle, in that castle he had a fair hall and spacious, and in that hall was he wont to sit in judgment."

The next important monument noticed is that called the *Tea-mur*. Of this there is now no vestige, but its situation is pointed out as on a little hill, which lies between the two *murs* (*septa*) to the south of *Rath na Riogh*, and the poem of Kineth O'Hartigan indicates that it was 60 f. in extent, and contained within it the sepulchre of the Milesian queen Tea.

Of the less remarkable monuments within the *Rath na Riogh*, the first is *Dumha na Bo*, or, the Mound of the Cow, called also *Glas Teamhrach*, which is described as lying to the west of *Dumha na n-Giall*. This is a circular mound 6f. high, and 40f. in diameter at the base. In illustration of the name or origin of this mound, no historical or even legendary account has been discovered. It may, however, be remarked, that innumerable legends respecting the cow, *Glas*, which belonged to the Tuatha De Danann smith, Gaibhnionn, are still traditionally current throughout Ireland.

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The second of these monuments is *Dumha na n-Giall*, or, the Mound of the Hostages. It is a circular earthen mound similar to that last mentioned, but of greater size, being 13 f. high, 25 f. in diameter at the top, and 66 f. in diameter at the base. The original purpose of this monument is, like that of the preceding, very obscure. In the poem of O'Lochain it is stated, that "King Cormac made a visitation of Ireland thrice, and brought a hostage from every fortress, which he exhibited at Temur, and that to these hostages he gave *Dumha na n-Giall*." From this passage, therefore, it would appear that this mound was the site of a habitation.

It was at the side of the preceding monument that the celebrated coronation stone, called the *Lia Fail*, was located in the time of the writers of the prose and verse already referred to; and it remained in the same situation till some years after 1798, when it was removed to its present situation in the Rath, called the *Forradh*, to mark the grave of the rebels, slain at Tara in the insurrection of that year. But the mound is still popularly called *Bod Fhearghais*, that is, *Penis Fergusii*, an appellation derived from the form of this stone.

The *Lia Fail* is spoken of, not only in these authorities but by all the ancient Irish writers, in such a manner as to leave no doubt that it remained in its original situation at the time when they wrote. Thus in the poem of Cuan O'Lochain:

> "The Rath of the synods of great powers
> To the north of the *Fal* of Temur,
> East of the Rath at the side of *The Stones*,
> Is the house from which Benen escaped."

And the prose account of the monument in like manner states, that "*Fal* lies by the side of *Dumha na n-Giall* to the north, i. e. the stone that roared under the feet of each king that took possession of the throne of Ireland. *Fal* was the name of this stone, that is *Fo-ail*, that is, the under stone, that is, the stone under the king."

A still stronger proof of its existence at Tara is furnished in the following verse quoted by Keating, and by the books of Lecan and Ballymote, from a poem of Kineth O'Hartigan, who, as already stated, lived in the tenth century:

In cloc ꝼoꝼꝼ ꝛaiꝛ mo ȯá ꝼáil	This stone on which are my *two heels*
huaiꝺi ꝼaiꝛeaꝼ Iniꝼ Ꝼail	From it is called *Inis Fail*,

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Eτeαρ δά eραιȝ ἐuile ἐeιnn	Between two shores of strong floods,
Maȝ Fail uile ρορ Eιρinn.	*Magh Fail* [is a name] for all Erin.

Dr. O'Conor, indeed—*Stowe Catalogue*, p. 27,—states, that "this stone is said to have been removed from *Temora*, the royal *Rath* of Meath, to *Cruachan*, the royal *Rath* of Connacht, at a remote period of time, and to have ceased to emit its usual sound, after it was profaned by Cuchullin, who resented its silence when his friend *Fiach*, an usurper, was inaugurated." But Dr. O'Conor appears to have entirely mistaken the sense of his author. The passage was obviously fabricated to sustain the claim to the Irish throne put forward in the twelfth century by the Connacian princes; and the statement found in the Irish MS. is simply, that the monarch, Cormac Mac-Art, saw *in a dream*, that the *Lia Fail* would be removed from Tara to Croghan, as in the following passage from the College MS. H. 2. 7, "Aiṫlinȝ do coimaic Coρmac ua Cuind i Temraiȝ .i. Eoco Ȝunnat riȝ Ulaḋ, ḋaρ leiṙ, do ṫiaċtain cu Temraiȝ, ocuṙ coiṫet na n-ȝiall do ṫocbail do a Temraiȝ reċtaiṙ, ocuṙ a bṙeṫ cu Cruaċain, ocuṙ a ṙaḋuḋ do a raiṫ Cruaċan." i. e. Cormac O'Cuinn saw a vision at Temur: that Eochy Gunnat, king of Ulster, came to Temur, and took the Stone of the Hostages away from Temur, and carried it to Croghan, and stuck it in the Rath of Croghan. The only value of such passages, however, is—and this is an important one—that they clearly identify the *Lia Fail* with the stone on the Mound of the Hostages. What then is to be thought of the legendary account given by all the Scottish historians from Fordun, Winton, and Boetius, down to the present time, that this stone—"the stone of fate," as they call it—was sent from Ireland for the coronation of Fergus Mac Ere, the first of the Dalriadic kings, in the fifth century, and that it was carried by Edward I. to Westminster, where it still remains, under the coronation chair of the monarchs of the British Isles? Now it is a remarkable fact, that though this Scottish account has been adopted by the Irish themselves, since the succession of the house of Stuart to the British throne seemed to verify the ancient prediction connected with it, yet no Irish account has been found to support it earlier than that of Keating, who evidently adopted the statement of Boetius' well known verse, which he quotes, with the palpable view of sustaining the right of the first Charles to his throne:—

> "Ni fallat fatum, Scoti quocunque locatum
> Invenient lapidem, regnare tenentur ibidem."

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It may also be observed, that between the Irish and Scottish accounts of the history of this stone there is a total want of agreement, which shews that the Scottish writers, when they recorded this tradition, were not acquainted with, or disregarded, the accounts of it preserved by the Irish. The Irish accounts uniformly state, that the *Lia Fail* was brought into Ireland from the north of Germany by the Tuatha De Danann colony; the Scottish, that it was brought from Spain by the Milesian chief, Simeon Breac, who, according to the Irish histories, was not a Milesian but a Fir-Bolg, or Belgian. The oldest Scottish authority for the tradition is the *Chronicon Rhythmicum*, written, as Innes would infer, at the close of the thirteenth century. But as this was about the period when the dispute commenced respecting the respective claims of the British and Scottish crowns to the ancient monarchy, and which shortly afterwards gave birth to the acknowledged forgeries which Fordun put into historic order, such accounts should be received with a caution proportioned to their improbability: and it is in the highest degree improbable that, to gratify the desire of a colony, the Irish would have voluntarily parted with a monument so venerable for its antiquity, and considered essential to the legitimate succession of their own kings. However this may be, it is an interesting fact, that a large obeliscal pillar-stone, in a prostrate position, occupied, till a recent period, the very situation on the hill of Tara, pointed out as the place of the *Lia Fail* by the Irish writers of the tenth, eleventh, and twelfth centuries; and that this was a monument of pagan antiquity, *an idol-stone*, as the Irish writers call it, seems evident from its form and character. Shortly after the year 1798, as already stated, it was removed from its ancient situation to the adjacent mound in *Rath na Riogh*, called the *Forradh*, to mark, as a grave stone, the remains of the rebels who fell there at that memorable period. And whether this stone be considered as a monument of remote antiquity, or as a record of the events of our own times, it must be regarded with interest; but if, in addition to this, such evidences have been adduced as may justify the supposition that it is the *Lia Fail* of Irish history, it will be difficult to find a rude monument of antiquity with which so many national associations can be connected.

The material of which this monument is composed is a granular lime-stone, very probably from some primary district; but whether it be Irish or foreign has not been ascertained: it may be remarked, however, that no granular lime-

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stone occurs in the vicinity. The stone is at present but 6 f. above ground, but its real height is said to be 12 f. To exhibit its form the accompanying wood-cut is given.

The features next claiming attention as situated on the eastern and western sides of the hill adjacent to *Rath na Riogh* are the wells called *Neamhnach* and *Caprach-Cormaic* on the east side, and that called *Laegh* on the west. *Neamhnach* is described, both in the verse and prose accounts, as pouring into the valley a stream called *Nith*, on which king Cormac first erected a mill in Ireland.

It is an interesting circumstance, that the historical fact here recorded respecting this mill is still vividly preserved, not only in its immediate locality, but also in many other parts of Ireland; and a mill—now called Lismullen Mill, from the district through which it flows—and situated on the north side of the river Guara, still exists on the reputed site of the ancient one. It may also be worthy of remark, that the present miller considers himself, and is considered by the people of the district, as the lineal descendant of the Pictish millwright brought over by king Cormac, though the original name of the family—*Mac Lamha*, or Hand—has, through the failure of the male line in his grandfather, become extinct.

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Respecting the meanings of the names of the well, *Neamhnach*, and the stream, *Nith*,—which is the name of a river in Scotland, and of another in the duchy of Triers, in Germany,—the conjectural etymology of the Irish writers has been already given at p. 76. On these conjectures nothing can be offered, except that *Neamhnach*, which signifies crystalline, clear, bright, would be an appropriate appellation for the well to which it was applied.

The probable truth of the historical tradition that this mill was the first of its kind erected in Ireland has been already inquired into, in the Ordnance Memoir of the Parish of Templemore, p. 215; but, as the passage is more immediately connected with the local history of Tara than of that parish, it will not be improper to give it in this place.

"It might be supposed from a passage in Dr. Ledwich, (see *Antiquities of Ireland*, p. 373,) that water mills were nearly unknown in this island until a comparatively recent period; but it would appear from ancient authorities, that they were even more common in ancient than they are in modern times, when the mechanical force of the mill, and the facilities of communication by roads, have been both increased. It is clear, from the Brehon Laws, (MS. *Trinity College*, Class E. Tab. 3, No. 5,) that they were common in the country at a very early period, and in the records of the grants of land to the monastery of Kells, preserved in its ancient book, [MS. *T.C.D.*—A. 1.6,] it would appear, than whenever the locality permitted, the *mill* was a common appendage to a *ballybetagh*, or ancient townland. For example: "Muinter Cennansa ro edpair Ard camma .i. baile in Uidrín cona muiliund ocus cona herund uili ocus baile ui Comgain cona herund uili ocus cona muiliund do Dia ocus do Cholumcille," &c. "The family of Kells granted Ard-camma, i. e. Ballyheerin, with ITS MILL and with all its land, and Ballycoogan, with all its land and with ITS MILL, to God and to Columbkille," &c. (*Book of Kells*, MS. *Trinity College*.) This grant was made in the middle of the eleventh century, and similar notices occur in the registry of Clonmacnoise about the same period. The charter also of lands granted to the monastery of Newry by king Muircheartach, or Mauritius M'Loughlin, about the year 1161, after enumerating the several townlands, adds, "*Has terras cum* MOLENDINIS, *ex dono meo proprio dictis monachis confirmavi*," &c. (*Clarendon* MSS. in the British Museum, vol. xlv. in Ayscough's Catalogue, 4792, Plut. VIII. c. p. 179.) The lives of

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Irish Saints show, that mills were erected by ecclesiastics, shortly after the introduction of Christianity, as the mills of St. Senanus, St. Ciaran, St. Mochua, &c. (See the lives of these Saints.) The mills of St. Lucherin and St. Fechin are noticed by Geraldus Cambrensis, and a mill at Fore, built on the ancient site of the latter, still exists, and is called St. Fechin's Mill. The Annals of Tighearnach, at the year 651, record, that the two sons of Blamac, (King of Ireland,) son of Hugh Slaine,—Donchad, and Conall,—were mortally wounded by the Lagenians in Maelodrain's mill. The Four Masters also, at the year 998, record, that a remarkable stone, called *Lia-Ailbe*, which stood on the plain of Moynalvy, in Meath, fell, and that the king Maelsechlain made four mill-stones of it.

From the preceding authorities, as well as from the classical etymology of the name, in Ireland as in every country in Europe, it might be supposed, that water mills were first introduced by Christian ecclesiastics. There is reason, however, to believe, that their introduction is of higher antiquity. Cuan O'Lochain, chief poet and lawgiver of Irerand, whose death is recorded in the Annals of Tighearnach, at the year 1024, states in his poem on the ruins then existing at Tara, that Cormac, the son of Art, chief monarch of Ireland, in the third century, had a beautiful *cumal*, or bondmaid, named Ciarnaid, who was obliged to grind a certain quantity of corn every day with a *bro*, or quern; but that the king observing her beauty, took her into his house, *and sent across the sea* for a millwright, (tuȝ ꝑaoꝑ Muillinn ταr móꝑ tinn,) who constructed a mill on the stream of Nith, which flows from the fountain of Neamhnach to the north-east of Tara. The ancient Irish authorities all agree in stating, that this was the *first* mill ever erected in Ireland; and it is remarkable, that this circumstance is most vividly preserved by tradition, not only in the neighbourhood where a mill still occupies its site, but also in most parts of Ireland. Tradition adds, that it was from the king of Scotland the Irish monarch obtained the millwright; and it can be shown, that the probability of its truth is strongly corroborated by that circumstance.

Professor Tennant, of St. Andrew's, in an ingenious essay on Corn-mills, states, that "the first corn-mill driven by water was invented and set up by Mithridates, king of Cappadocia, the most talented, studious, and ingenious prince of any age or country. It was set up in the neighbourhood of his capital, or palace, about seventy years before the commencement of the Christian era.

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It was probably from this favourable circumstance of the invention of the water-mill, and the facility thereby afforded to the Cappadocian people for making cheap, good, and abundant flour, that the Cappadocian bakers obtained high celebrity, and were much in demand for two or three centuries posterior to the invention of mills, throughout all the Roman world. Coincident with the era of the inventor, as mentioned by Strabo, is the date of the Greek epigram on water-mills by Antipater, a poet of Syria, or Asia Minor, who is supposed to have lived sixty or eighty years before Christ. This epigram may be thus translated :—

> " Ye maids who toil'd so faithful at the mill,
> Now cease from work, and from these toils be still;
> Sleep now till dawn, and let the birds with glee
> Sing to the ruddy morn on bush and tree ;
> For what your hands performed so long, so true,
> Ceres has charged the water-nymphs to do :
> They come, the limpid sisters, to her call,
> And on the wheel with dashing fury fall,
> Impel the axle with a whirling sound ;
> And make the massy mill-stone reel around,
> And bring the floury heaps luxuriant to the ground."

" The greater convenience and expedition in working of these water-mills soon made them be spread over the world. In about twenty or thirty years after their invention, one was set up on the Tiber. They must have been not uncommon in Italy in the age of Vitruvius, for he gives a description of them. Yet it is rather surprising that Pliny, whose eye nothing of art or nature escapes, has taken no notice of them."

This learned writer, however, errs respecting Pliny. The following passage is quite conclusive on this subject: "*Major pars Italiæ ruido utitur pilo, rotis etiam quas aqua verset obiter, et molat.*" (*Hist. Nat.* lib. 18, c. 10.) Whitaker shews that a water-mill was probably erected by the Romans at every stationary city in Roman Britain : they were certainly numerous during their time ; and this fact strongly corroborates the date assigned to the erection of the mill near Tara, as well as the tradition which refers its origin to Scotland, and particularly to the Roman portion of it, which lay nearest to Ireland, and was, during the reign of Cormac, in the possession of the Picts.

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The well, *Caprach-Cormaice*, which is described both in the verse and in the prose accounts, as situated under *Rath na Riogh* to the east, and consequently south of the well *Neamhnach*, is no longer to be found; nor is any tradition of its former existence now preserved; but the name *Caprach*, or *Cabrach*, as it is written by the O'Clerys, is still preserved in the adjacent townland, through which its streamlet evidently flowed. No certain etymology of this word *Cabrach* can be given, though it is the name of several townlands in Ireland. According to the prose account, this well had three other names: *Liagh*, *Tipra-bo-finne*, and *Deare dubh*:* of these, the first, *Liagh*, signifies a physician, cognately with the English word *Leech*; the second, *Tipra-bo-finne*, the well of the white cow; the third, *Deare-dubh*, the dark eye.†

The third and last of these wells is that called *Laegh*, situated, according to the verse and prose accounts, on the slope of the hill west of *Rath na Riogh*, and sending a stream directly westwards. This well is also dried up, or diverted from its original situation, but the ground immediately below its site is still watery. The signification of the name of this well is placed beyond conjecture by an ancient Irish saying, quoted in the prose description, in allusion to its situation as contradistinguished from that of the well *Liagh*: "The calf (*Laegh*) never goes to the physician, (*Liagh*,) the one," it adds, "being to the east and the other to the west of Temur." The meaning of the name is also explained in a passage full of interest, in Tirechan's annotations on the life of St. Patrick, —fol. 10, *b*, 1.

Porro fundavit aeclesiam *i Carric Dagri*, et alteram æclesiam *immruig Thuaithe*, et	Moreover he founded a church at *Carric Dagri*, and another church at *Mruig Thuaithe*, and

* In Cuan O'Lochain's poem, as preserved in the O'Clerys' *Leabhar Gabhala*, the three additional names of this well are *Lia*, *Daeldubh*, and *Duirbh Tuath-linde*. In the copy preserved in the Book of Ballymote the three names are Dael, Duirbh Tuath-linde, and Tipra Bofinne. In another poem, ascribed to Caoilte, describing *Tara*, mention is made of a well at Tara, called *Poll tocair na tuilicke*, which is probably only another name for this. It is described as boiling with great strength from the ground, and as having been used for the ordeal by water—the guilty person who went into it being marked with a black spot on his skin, and the innocent one appearing fairer than ever.

† Thus in Hebrew, עין־גדי, "kid's eye"—the En-gedi of Scripture. *Eye* is commonly used for *well* in Hebrew.

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scripsit elimenta Cerpano; et intravit in domum regiam, et non surrexerunt ante se, nisi unus tantum, hoc est Hercus sacrilegus, et dixit illi, Cur tu solus surrexisti in honorem Dei mei in me? Et dixit ei Hercus, nescio quid; video scintellas igneas de labiis tuis ascendere in labia mea. Sanctus quoque dixit, si babtisma Domini accipies, quod mecum est? Respondit, accipiam. Et venierunt ad fontem *Loigles* in Scotica, nobiscum *vitulus civitatum*. Cumque aperuisset librum atque babtitzasset virum Hercum, audivit viros post tergum suum se inridentes ad invicem de rei illius consideratione, quia nescierunt quid fecerat. Et babtitzavit tot milia hominum in die illa.

he wrote elements for Cerpan; and he entered into the royal house, and they did not rise up before him, except one only, that is Hercus Sacrilegus,* and he said unto him, Why hast thou alone risen up to the honour of my God in me? And Hercus replied to him, I know not why; I see ignited sparks ascend from thy lips to mine. The saint also said, Wilt thou receive the baptism of the Lord, which is with me? He answered, I will. And they came to the fountain [called] in the Scotic *Loigles*, with us the *calf* of the *cities*. And when he had opened the book and had baptized Hercus, he heard men behind his hack deriding him on account of that thing, because they knew not what he had done. And he baptized many thousand men on that day.

The ruins of *Cuchtair Cormaic*, or Cormac's Kitchen, now obliterated, were situated over the brink of this well, to the east; that is, between it and the external ring of *Rath-na-Riogh*.

On the same *Leiter*, or slope of the hill, in which this well was situated, and not far to the west of *Rath-na-Riogh*, the prose account places two stones marking the sepulchres of Cu and Cethen. These monuments were to the south of the well, and, like it, have disappeared. The verse, with equal distinctness, points out the situation of these monuments, but adds another feature called *Cnoc-bo*, or the Hill of the Cow, of which also there is no trace. The destruction of these monuments is at once accounted for by the fact, that this side of the hill has been long under cultivation. Respecting *Cnoc-bo*, no historical account is given, but the sepulchral stones of Cu and Cethen, according to the prose account, owe their origin to two distributors, or servants, of Cormac's household, as thus stated:

"Cu slew Cethen, Cormac's *Rannaire* (distributor) in the presence of Cormac, in the middle of the house, and then passed westwards under the height of Temur, but was pursued and killed by the brother of him whom he had slain. And though Cormac said that Cu should not be slain yet no one interposed until

* Query *laugiver?* "Ar e an t-Earpucc Eirc ri ro ba breithem do Patraic." i. e. It is this Bishop Eirc who was brehon [judge] to Patrick.—*Four Masters, ad ann.* 512.

he was killed (simul) at once, so it has become a common saying, 'they have acted like Cu and Cethen.'"

On the slope of the hill, to the east of *Rath na Riogh*, the same authorities place the *Leacht*, or Monument, of *Maine, the son of Muinremhar*. This also has been destroyed by the progress of cultivation, and nothing has been discovered relative to its history. Muinremhar, the father of Maine, according to the ancient tale entitled *Tain Bo Cuailgne*, was Lord of *Mughdhorn*, a district in the County of Monaghan, in the time of Cuchullin, who flourished in the first century.

Imperfect as the historical notices of the preceding monuments are, it will be seen that they are nearly all connected with king Cormac's time, or the close of the third century, a period quite within the limits of real Irish chronological history.

The great feature next to be noticed is of still later date, namely, the *Rath of Laoghaire*, who, as already shewn, according to all the Irish authorities, became monarch of Ireland in 428 or 429, and died in 463. The situation of this Rath, with its *Lios*, or circumvallation, is distinctly pointed out in all the authorities as south of *Rath na Riogh*; and it is stated in the prose account, that "it had four principal doorways facing the cardinal points." The progress of cultivation on the hill has totally destroyed the internal features, and nearly effaced a considerable portion of the external rampart of this fortress. But though the western portion of the rampart only remains in any degree of preservation, it is sufficient to show that, like that of *Rath na Riogh*, it consisted of a double ring, of which the outer one only is now strongly developed. This Rath occupies that part of the southern end of the hill at the foot of the first slope, where there is a piece of nearly flat ground. The part of the outer circle now remaining is on the edge of the western slope, and the accompanying section, which is from west to east, and on a scale of 120 feet to an inch, will shew the measurements along the slopes.

The eastern, southern, and northern parts have been levelled, but the line they occupied can still be traced, and the diameter appears to have been 300 f.

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Of the *Rath* there are no remains. The poem states, that the monument of Laoghaire was in the middle of his *Lios*, partly broken by an upright witness. The prose account, with greater distinctness, states, that the body of Laoghaire stood (interred) in the external rampart of his royal Rath, to the south-east, with his shield of valour, and with his face to the south, (as it were) fighting against the Lagenians.

This is still more distinctly detailed in a historical tract in *Leabhar na Huidhre*, a MS. written at Clonmacnoise in the twelfth century, in the possession of Messrs. Hodges and Smith, entitled "The Meeting of Patrick at Tara and the Death of Laogaire:"—fol. 76, p. *b*, col. 2.

Doí Loegaire tríchi m-blíadan ican rin iprigi n-Erenn, hi comling fri Patraic, ocus ba do réir Patraic cena boireom. Luid iarom Loegaire slogud co Laignib, do éuicsin na doromi forsab. Ro éiscrset Laigni ocus do ruscsit cath dó, ocus marbi for Loegaire in cath, .i. cath Ádai tsara. Ro gabsad Loegaire ic in áth, ocus do breéa naéa fri Laignib, .i. grían ocus erca, urci ocus aer, la ocus anaig, muir ocus sír, connà iarfud in m-doromi cétn bad beó. Ro leced arr iarom. Ireó ersa ro suirgsiged do Loegaire co mbad eesp Erinn ocus Albain, fogebad a aitsi, conid de sin na deochaidsium muirdóblaé riam. Luid ersa Loegaire dorigri slogud már co Laignib, do gairgid na doromi forsab. Ní éuc imorru a raéa ni dib. O ranic iarom Greallach n-Dairi, for each Chairr, immaig Life, eesp na dá cnoc .i. Erinn ocus Albu a n-anmand, adbaé and sin for a gnem ocus a gaé, ocus o na raéab ar cena, ár ní laemée eudeéc suirgiu ic ind amsir sin. Conid de sin ar berc in filí:

Loeghaire was afterwards thirty years in the government of Ireland, in friendship with Patrick, and obeying Patrick's will. Loeghaire went afterwards with an army to the Lagenians, to demand the Boru of them. The Lagenians assembled and gave him battle, and Loeghaire was defeated in it, that is, in the battle of *Athdara*. Loeghaire was taken in the battle, and he gave the Lagenians guarantees, that is, the sun and moon, the water and the air, day and night, sea and land, that he would never during his life demand the Boru. He was then set at liberty. It was prophesied to Loeghaire that he would receive his death between *Erin* and *Albain*, [Ireland and Scotland,] for which reason he never went on a naval expedition. But Loeghaire went again with a great army to the Lagenians, to demand the Boru of them. [For] he did not pay any regard to his oaths. But when he reached *Grellach Daphil*, by the side of *Cassi*, in *Magh Lipbi*, between the two hills, *Ere* and *Alba* their names, he was there killed by the sun and the wind, and by the other guarantees, for no one dared to dishonor them at that time. Of that, the poet said:

Ac bad Loegaire, Mac Neill,
For each Chairr—glar a sin—
Dúli de, ad roegaid raid,

Loeghaire, son of Niall, died,
By the side of Cassi—green the land—
The elements of God, whose guarantee he had violated,

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Tucpao oal bair forr in rig.
In cat i n-Ath Dara deis,
Irracbao Loegaire, Mac Neill,
Nárao fír na n-dula de,
Ised ro marb Loegaire.

Tucad dam corp Loegaire aneir isnearn, ocus ro h-adnacht co n-ard gairciud ir in dun imdegail airdeir-descertach rigraidi Loegaire hi Temraig he, ocus a aiged ro oer for Laignib oc caidgud frie, ar ro nama rom na biú do Laignib.

Da ri dan Ráth Loegaire Teoc Midcuarta in tan sin, ocus ir airi con atbeth rom a adnacul ann.

Inflicted the doom of death on the king.
In the battle of the rapid ford of *Dara*,
Was Loeghaire, son of Niall, taken;
The just vengeance of the sacred elements
It was, that killed Loeghaire.

The body of Loeghaire was afterwards brought from the south, and interred with his arms of valour in the south-east of the external rampart of the royal *Rath Loeghaire*, at Temur, with his face turned southwards upon the Lagenians, [as it were] fighting with them, for he was the enemy of the Lagenians in his lifetime.

Rath-Loeghaire was the *Teach Midhchuarta* at that time, and it was therefore he requested that he should be interred therein.

This passage, which is so valuable for the information which it affords respecting the objects of worship among the pagan Irish, is corroborated to a considerable extent by an authority of still higher antiquity, the annotations on the life of St. Patrick, by Tirechan, in which the following statement appears:

"Perrexitque ad civitatem *Temro*, ad Loigairium, filium Neill, iterum quia apud illum foedus pepigit ut non occideretur in regne illius, sed non potuit credere, dicens: Nam *Neel* pater meus non sinivit mihi credere, sed ut sepeliar in cacuminibus *Temro* quasi viris consistentibus in belle: quia utuntur gentiles in sepulcris armati prumptis armis facie ad faciem usque ad diem *Erdathe* apud Magos, id est judicii diem Domini. Ego filius Neill et filius [filiumr] Dunlinge *im Maistin* in Campo *Liphi* pro duritate odivi, ut est hoc."—*Fol.* 10, *a*, 2.

And he [Patrick] repaired again to the city of *Temro* to Loigairi, the son of Niall, because he had ratified a league with him that he should not be slain in his kingdom; but he could not believe, saying, For Neel, my father, did not permit me to believe, but that I should be interred in the top of *Temro*, like men standing up in war. For the pagans are accustomed to be buried armed, with their weapons ready face to face, [in which manner they remain] to the day of *Erdathe*, among the Magi, i. e. the day of the judgment of the Lord. I the son of Niall, hated the son of Dunling, in *Maistin*, in the plain of the *Liphi*, for his severity, *ut est hoc*.*

Close to the south-east side of this *Rath Laoghaire*, the prose description places the *Leacht*, or monument of *Mata Morglonnach*, (the great-deeded,) a treacherous soldier of Cormac's household. Nothing is told of him but that he

* Something wrong here in the original MS.

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buried alive four youths who were playing at a game at a spot lying to the south-east of *Rath Laoghaire*, that is, as it would seem, on the spot on which the monument was afterwards raised; for though the monument popularly bore the name of Mata, it is more probable that it was raised as a memorial of the event, according to the custom still preserved in Ireland, than as a sepulchre for Mata. This monument is also destroyed.

Proceding now to the monuments situated to the north of *Rath na Riogh*, the first in importance is that called *Rath-na-Seanadh*, that is, Rath of the Synods. The situation of this enclosure is distinctly pointed out both in the verse and prose accounts, as lying opposite to the Mound of the Hostages and north of the *Lia Fail*. It is evident, that the age of this Rath is anterior to the events of which it was the theatre, and from which it received the popular name preserved in these records, but its original name cannot now be ascertained. The ecclesiastical assemblies held here, are noticed only in the poem; and were, first, the synod of Patrick; second, the synod of Ruadhan and of Brendan; and lastly, the synod of Adamnan, pronouncing a curse against Irgalach. The occasion of the first and second of these synods has been already noticed, namely, the attempt to convert the monarch Laoghaire and the Irish chiefs by Patrick, and the cursing of King Dermot by Ruadhan, which was the cause of the desertion of Tara, on the death of that monarch, in 565.

Of the synod of Adamnan no account has been found more satisfactory than the indistinct notice in this poem, but the purpose for which it was held is stated in the following somewhat legendary manner in the *Leabhar Breac*, fol. 38, *b*. and a similar account is found in the Book of Lecan, fol. 166, p. *a*, col. 1.

Adamnan do rala in aroile lou oc imdeche Muige Breag, ocus a maccair for a mun, co n-accaer na da chach ic ambuaracain a chelu. Gemaing am Ronaic, maccair Adamnain, conur acaid in mnai ocus corpan iarainn in a laim, ocus fi oc carpaing na mna eli ar in chach chorupraí, ocus hi lenmain a cich froe boi in corpan. Ar cuma no bieir fir ocus mnai oc tabaire chachai ir in aimsir sin. Suidi Ronaic iarum, ocus ar bere nim berusa

Adamnan happened to be travelling on a certain day through the plain of Bregia with *his mother on his back*, when they saw two armies engaged in mutual conflict. It happened then that Ronait, the mother of Adamnan, observed a woman with an iron reaping-hook in her hand, dragging another woman out of the opposite battalion with the hook fastened in one of her breasts. For men and women went equally to battle at that time. After this Ronait sat down, and said thou wilt not bring me from this spot

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lar ar in inaid ra co ra raerchar mná erna brethu ap in n-gne ucur, ocur ap peche ocur fluaguo. Gellaid iarum Adamnan in ni sin. Ecmaing ena iarum morbail i n-Erinn, ocur teit Adamnan co popglan clerech Erenn ir in aenl sin, ocur raerair na mna ina.

until thou exemptest women for ever from being in this condition, and from excursions and hostings. Adamnan then promised that thing. There happened afterwards a convocation in Ireland, and Adamnan, with the choice part of the clergy of Ireland, went to that assembly, and he exempted the women at it.

Iesse ro oin cetre Cana Erenn .i. Cain Patraic, cen clerchiu oo marbuo; Cain Dairi Chaillech, cen bu oo marbuo; Cain Adamnain cen na mna oo marbuo; Cain Domnaig cen eirmetheche ano.

These are the four *Caina* of Ireland, namely, the *Cain* of Patrick, not to kill the clergy; the *Cain* of Dari, the Nun, not to kill cows; the *Cain* of Adamnan, not to kill women; the Sunday *Cain*, not to travel on it.

Respecting this synod of Adamnan, the Irish annals are silent; but Colgan, *Acta SS.* p. 566, and *Trias Thaum.* p. 503, speaks of a synod held by Flan, archbishop of Armagh, in 694, or 695, to the Acts of which the names of the saints Mochonna and Adamnan were subscribed. It appears, however, from the Acts of this synod, a copy of which was in Colgan's possession, and of which there is also a copy in Marsh's library, in a book entitled *Presidents of the See of Armagh*, MS. p. 395, that this synod must have been a different one from that held at Tara, which was probably convened for the purpose of denouncing the unchristian custom still remaining among the people of Bregia, in his time, as the Iorgalach whom Adamnan denounced was, according to the Annals of Tighearnach, king of Bregia; and was killed by the Saxons in 701. And if conjecture may be indulged as to the date of this synod, it was, most probably, in the year 697, when, according to the Annals of Tighearnach, Adamnan brought a law with him into Ireland—Adomnan tuc pecht leis in Erinn an bliadain rea; or, as it is stated in the Annals of Ulster, at the year 696, which are a year antedated; *Adomnanus ad Hiberniam pergit, et dedit legem innocentium populis.* The renewal of this law in Ireland is recorded at the year 727, by Tighearnach—*Adamnani reliquiæ transferuntur in Hiberniam, et Lex renovatur.* However this may be, the passage in the *Leabhar Breac* is valuable for the light which it throws on several records in the Irish annals, respecting the establishment at various times of the *Cain Phatruic*, *Cain Dairi*, *Cain Adamnain*, and *Cain Domnaigh*, which records Dr. O'Conor most erroneously supposed to refer only to the establishment of monastic rules. Thus of the *Cain Phatruic*, which is otherwise called in the annals *Lex Patricii*.

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A. D. 737. *Lex Patricii tenuit Hiberniam.*

737. The Law of Patrick prevailed in Ireland.—*Tig.*

A. D. 782. Scaṁach ꝓoꝛuꝛ cano *Patricii* hi Cꝛuaċnıḃ la Dubḋaleıṫi ocuꝛ la Tıꝛꝛaıṫe *filium* Taıoġġ.

782. The promulgation of the Law of Patrick at Croghan by Dubhdalethe and by Tipraite, the son of Tadhg.*—*Ann. Ult.*

A. D. 798. *Lex Patricii* ꝓoꝛ Conaċtu la Ġoꝛmgal Mac Dınnaṫaıġ.

798. The Law of Patrick in Connaught by Gormgal, the son of Dinnatach.—*Ann. Ult.*

A. D. 805. *Lex Patricii* la hAeḋ Mac Neıll.

805. The Law of Patrick by Aedh, the son of Niall.—*Ann. Ult.*

A. D. 810. Nuaḋa Aḃaḋ Aꝛmaċae *migravit* co Connaċtaıḃ *cum lege Patricii, et cum armario ejus.*

810. Nuada, abbot of Armagh, went to Connaught with the Law of Patrick and with his armory.—*Ann. Ult.*

A. D. 822. *Lex Patricii* ꝓoꝛ Mumaın la Feıḋlımıḋe Mac Cꝛemṫaınn, ocuꝛ la h Aıꝛtꝛıġ Mac Concoḃaıꝛ, .ı. Eꝛꝛcoꝑ Aꝛmaċa.

822. The Law of Patrick in Munster by Feidhlimidh, the son of Cremthann, and by Airtri, the son of Concobhar, Bishop of Armagh.—*Ann. Ult.*

A. D. 824. *Lex Patricii* ꝓoꝛ ceṫꝛa Conaċtaıḃ la Aıꝛtꝛıġ Mac Concoḃaıꝛ, .ı. Eꝛꝛcoꝑ Aꝛmaċa.

824. The Law of Patrick in the three divisions of Connaught by Airtri, son of Concobhar, Bishop of Armagh.—*Ann. Ult.*

A. D. 835. Deꝛmaıṫ ḋo ul co Conaċtaıḃ *cum lege et vexillis Patricii.*

835. Dermait went to Connaught with the Law and *Vexilla* of Patrick.—*Ann. Ult.*

And thus of the *Cain Dairi:*

A. D. 811. *Lex* Daꝛı ꝓoꝛ Conaċtu.

811. The Law of Dari in Connaught.—*Ann. Ult.*

A. D. 812. *Lex* Daꝛı la hu Neıll.

812. The Law of Dari among the Hy-Niall.—*Ann. Ult.*

A. D. 825. *Lex* Daꝛı co Conaċtaıḃ *iterum.*

825. The Law of Dari [brought] into Connaught again.—*Ann. Ult.*

And again of the *Cain Domhnaigh:*

A. D. 884. Anaṁloen, an e-aṁlıḋ, coꝛ ın Eꝛıꝛeıl ḋo ꝛaḋaḋ ḋo nım ın Ieꝛuṡalem co caṁ Domnaıġ aġuꝛ ꝓoıꝛceclaıḃ maıṫe ḋo ṫıaċtaın an Eꝛınn.

884. Ananloen, the pilgrim, came to Ireland with the epistle which was given from heaven at Jerusalem, with the Sunday Law and with good instructions.—*Four Masters.*

Though these four *cains*, or laws, are stated in the *Leabhar Breac* to be pre-eminently the four *cains* of Ireland, yet the establishment of several other *cains*

* Dr. O'Connor knew so little of the nature of these *cains* that he translates this entry in the Annals of Ulster most erroneously, thus:—"Solutio tributi scientiarum S. Patricii, facta in Regia Connaciæ, dicta Cruachan, a Dubdalethea, et Tipratio filio Thadæi."

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is also recorded, the nature of which remains to be ascertained. Of the penalties consequent on the infringement of some of these, including the *Cain Adamnain*, a statement is found in a fragment of the Brehon Laws preserved in the Library of Trinity College,—H. 4, 22, p. 37, col. *b.*—which is given below, though, till a glossary of the technical terms in those laws be discovered the sense must remain in a great degree obscure.*

From the preceding notice of a convention, or synod, having been held at Tara in the seventh century, it appears, that though no longer the residence of the kings, Tara was still occasionally selected as a place for ecclesiastical assemblies. A later instance of such assemblies there is thus recorded in the Annals of Ulster at the year 779: "Congressio Sinodorum Nepotum *Neill* et *Laginensium* in oppido *Temro*, ubi fuerunt Scribe et Ancorite multi, quibus dux erat *Dublitter*."

Of the illustrious man whose name is connected with this and other monuments at Tara, it would be superfluous to give any lengthened notice in this place. As the distinguished author of the Life of St. Columba, his predecessor in

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* Rıé cana Phaeṗuıc co moṗfeıup .ı. ṗeche cumaıl caé laıṁe co moıṗ feıṗıuṗ.

Rıé cana Ꝺıaṗmaꝺa co nonbuṗ .ı. ṗeche cumala caéa laıme co nonbuṗ.

Rıé cana ꝺoıleachea co ceo laech .ı. leıé ṗeche cuṁala cacha laıṁe co ṗıa ceo laech.

Rıé cana Aꝺaṁnaın co mile .ı. cech-ṗaımche, ṗeće cumala caéa laıme co mile.

Rıé caıṗꝺe ɣ ꝺıgeꝺ ꝺıgona co ɛṗı nonꝺuṗaıꝺ; olaıṁṗıaćaıꝺe aceṗṗaımeı ṗıać laın ṗıaé ap ın ceo nonbuṗ, ocuṗ leeṗıach ap noenbuṗ ɛıṁaıṗeı ocuṗ ceıṗaımeı ap ın eṗeṗ nonbuṗ a caıṗꝺe .ı. ṗeche cuṁala cacha laıme co ɛṗı nonbup a nolıġeo aṫgona ɛṗı cuṁala a ṗlaċhe ṗlóıġ a caıṗoı. ṗıé comoṗ ṗeıṗeṗ no co ɛṗı nonꝺuṗaıꝺ ꝺoṁa h-eıeıṗeꝺaıꝺ, ocuṗ a m-beıe co ꝺıaṗṁe ꝺo na heıeıṗeꝺaıꝺ.

The *Rith* of *Cain Patrick* [extends] to seven, i. e. seven *cumals* for every hand, as far as seven.

The *Rith* of *Cain Dermot* [extends] to nine, i. e. seven *cumals* for every hand, as far as nine.

The *Rith* of *Cain Boileachta* [extends] to one hundred laics, i. e. the half of seven *cumals* for every hand as far as one hundred laics.

The *Rith* of the *Cain Adamnain* [extends] to one thousand, i. e. the fourth of seven cumals for every hand as far as one thousand.

The *Rith* of respito and the law of *Digon* (wounding) [extends] to three times nine persons; the full fine extends to four *cerraimthi*; the full fine on the first nine, half fine on the second nine, and a quarter fine on the third nine among friends, i. e. seven *cumals* for every hand as far as three times seven persons in the Law of *Digon*, three cumals for a *slicht sloigh* in the *Dligheđ Ciarde*.

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the Irish abbacy of Iona, and of the description of the places of the Holy Land, from the relation of Arculph, a French bishop, but still more as the person of whom such an honorable character is given by Bede—as a wise and good man, and one exceedingly well versed in the Holy Scriptures, greatly studious of peace and unity,—the celebrity of his acts must be familiar to the readers of British history. He was born in 624, and died at Iona in 704. Some works of his—as the *Visio Adamnani*—not yet published, are preserved in the Library of Trinity College.

The remains of the Rath of the Synods, which is now popularly called the King's Chair Rath, are situated on the top of the hill. It appears distinctly to have had two external fosses and parapets; but the outer ring has been partly destroyed on the eastern side by the erecting of the church-yard wall, and part of it has been removed on the southern side to spread over land. Within these enclosures are two Raths or mounds, of which the larger, situated to the south-east, is 106 f. in diameter, and the smaller, situated to the north-west, is 33 f. It is this latter mound which is popularly called the King's Chair; but it should properly be called the Mound of *Pupall Adamnain*, or the Tent of Adamnan, which, though unnoticed in the verse, is distinctly described in the prose as being situated within this Rath. This mound is surrounded by a ditch, and is higher than the larger Rath, being 7½ f. from the ground on its north-western side, and 5½ f. on its south-eastern side, while the larger Rath is but 4 f. from the ground. The general measurements will appear from the section, which is taken north-west and south-east, and on a scale of 60 f. to an inch.

The other memorials of Adamnan noticed in the prose account as being situated to the east of the Rath of the Synods are: first, his Cross; and south of this, his Mound and his Seat. The locality of these monuments is enclosed within the boundary of the churchyard, and the Mound and Seat no longer exist; but the shaft of the Cross still remains in the very situation described. It is of red sandstone—the usual material of such monuments—and has a figure rudely sculptured in relief on one side. Its height is about 6 f., and its breadth 1½ f.

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A short distance to the south-east of Adamnan's cross was situated, according to the prose account, which is corroborated by the verse, the house from which Benen, the disciple of St. Patrick, escaped, and in which Lucad the Bald, the druid of king Laogaire, was burned. The site here pointed out is also within the boundary of the churchyard. The legend with which this feature was connected is of the class commonly found in the lives of the saints, and is given with various degrees of detail in all the lives of St. Patrick. Its origin, however, is of very high antiquity, as it appears in the tripartite life, and in the notices of the saint's life, by Maccuthenius and Tirechan, preserved in the Book of Armagh. The story is thus told by Maccuthenius; and, as the text is very corrupt, an English translation is added: (Fol. 5, p. *a*, col. 2, *et seq.*)

His autem omnibus in conspectu regis [mirabiliter gestis—*Probus*] inter magum Patriciumque, ait rex ad illos; libros vestros in aquam mittite, et illum cujus libri inlesi evasserunt, adorabimus, Respondit Patricius, faciam ego; et dixit magus, nolo ego ad judicium aquæ venire cum isto, aquam enim deum habet; certe audivit babtisma per aquam a Patricio datum. Et respondens rex ait, per-

"All these things being done in sight of the king, between the magician [*Lucetmail*] and Patrick; the king says to them, cast your books into the water, and him whose books shall escape uninjured, we will adore. Patrick answered, I will do so. And the magician said, I am unwilling to come to the trial by water with that man, because he has water as his god: for he had heard that baptism was given by Patrick with

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mitte per ignem ; et ait Patricius, prumptus sum ; at magus nolens dixit, hic homo versa vice in alternos annos, nunc aquam, nunc ignem, deum veneratur. Et ait Sanctus ; non sic, sed tu ipse ibis, et unus ex meis pueris ibi tecum in separatam et conclaussam domum, et meum erga te, et tuum erga me erit vestimentum ;* et sic simul incendemini. Et hoc consilium insedit, et aedificata est eis domus, cujus dimedium ex materia viridi, et alterum dimedium ex arida facta est : et missus est magus in illam domum in partem ejus viridem, et unus ex pueris Sancti Patricii *Bineus* nomine, cum veste magica in partem domus [aridam—*Probus*]. Conclussa itaque extrinsecus domus, coram omni turba incensa est : et factum est in illa hora, orante Patricio, ut consumeret flamma ignis magum cum dimedia domu viridi, permanente cassula Sancti Patricii tantum intacta, quia ignis non tetigit. Felix autem *Beninens* e contrario cum dimedia domu arida, secundum quod de tribus pueris dictum est, non tetigit eum ignis, neque contristatus est, nec quicquam molesti intulit, cassula tantum magi, quæ erga eum fuerat, non sine Dei nutu, exusta.† Et iratus est valde rex adversus Patricium de morte magi sui, et inruit poene in eum, volens occidere, sed prohibuit illum Deus : ad precem enim Patricii, et ad vocem ejus, discendit ira Dei in verticem suum ; et timuit rex vehimenter, et commotum est cor ejus, et omnis civitas cum eo."

water. And the king answering said, allow it by fire : and Patrick says, I am ready ; but the magician, being unwilling, said, this man alternately in each successive year, adores as God, water and fire. And the saint says, not so, but thou thyself shalt go, and one of my boys shall go with thee, into a separate and closed house, and my vestment shall be on thee, and thine on him ; and thus together you shall be set on fire. And this counsel was approved of, and there was a house built for them, the half of which was made of green wood, and the other half of dry : and the magician was sent into that part of the house which was green, and one of the boys of St. Patrick, *Bineus* by name, with the vest of the magician, [was sent] into the dry part of the house. The house then being closed outside was set on fire before the whole multitude : and it came to pass in that hour, by the prayers of Patrick, that the flame of the fire consumed the magician with the green half of the house, while the garment of St. Patrick remained untouched, because the fire did not touch it. But the fortunate *Beninens*, on the contrary, together with the dry half of the house, according to what is said of the three children, was not touched by the fire, neither was he annoyed, nor did he experience any inconvenience, only the garment of the magician which he had about him, was burned, not without the permission of God. And the king was greatly indignant against Patrick on account of the death of his magician, and he had almost rushed upon him, desiring to slay him, but God prevented him : for at the intercession of Patrick, and at his entreaty, the wrath of God descended on his head, and the king feared excessively, and his heart was disturbed, and all the city with him."

* Et meum apod te, et tuum apod meum puerum erit vestimentum.—*Probus.*

† Non tetigit ignis, neque contristavit, nec quicquam molestiæ intulit, vestimento Magi, quod circa eum fuerat, non sine Dei nutu, exusto.—*Probus.*

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The same legend is told by Jocelyn, but in far better language and order of narration.—See *Trias Thaum.*, and Swift's translation of Jocelyn, p. 67. The boy Binen, or as his name was Latinized, Benignus, was afterwards placed over the church of Armagh by St. Patrick, in 455. He resigned this dignity in 465, and died in 468.

The feature next to be noticed was also evidently situated within the boundary of the churchyard, or perhaps a little to the south of it, namely, the House of Mariseo. The poem states, that this house was situated to the north, on the brink of the well Neamhnach; and the prose account agrees. It is stated to have been high at its northern and western sides, and low at the eastern—a description which would apply to its locality on the side of the hill. The poem states, that Mariseo was the female of greatest beauty in all Ireland; and the prose adds, that she was a widow who was cotemporary with Cormac.

The poem adds an interesting particular connected with this locality, that from this house out towards Meath, that is, along the side of the hill to the east of the road, the houses, or dwellings of Temur, were spread.

Proceeding in the order of the prose description, the monuments next to be noticed are the three stones which marked the graves of the druids, Mael, Blocc, and Bluicni. These stones were situated at the side of the *Rath of the Synods*, to the north; and with respect to each other, that of Mael to the east, Blocc to the south, and Bluicni to the north. The poem states, that these stones had been cast or thrown here by the great Mal of Macha. This Mal, according to the Annals of Tighearnach, was king of Emania, or Emhain Macha, for thirty-three years, and commenced his reign in the year 130.

It would appear from a legendary story of very great antiquity, preserved by Duald Mac Firbis, that two of these stones were supposed to have served a higher purpose than as mere gravestones; and that they acted a part in the royal drama of the coronation not less important, though less noisy, than the *Lia Fail* itself. This story is as follows:

Cl m-baeɔap Laiġin, ocuṙ Cineul Cuinn Ceuo-chathaiġ oġ benaṁ riġ i n-Ɔeaṁair ɛaṙ ɛiṙ Ɵiɛeṙġeil, baoi ɛaṁbaɛ riġ i n-Ɔeaṁraiġ no ġabaɔaṙ oa eaɛ aonbaéa, naɔ paġbaɔaṙ riaṁ ro'n ġ-ɛaṁbaɛ. Cin ei naɔ

When the Lagenians and the race of Conn of the Hundred Battles were electing a king at Temur after Ederscel, there was a king's chariot at Temur, under which were yoked two horses, of one colour, which had never been yoked under a chariot before. This

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aipeimeaó plaiḋ Teaṁpaċ conoġbaṫ an cappaṫ fṁir co naċ mo caṫ, aġur conleiceir ṁa h-eiṫ fṁir; aġur baṫ caṫal piġ ir in cappaṫ, aġur in ei naṫ uipṁi plaiḋ Teaṁpaċ bo ro ṁóir oo an caṫal. Aġur baeṫar oa liaġ i o-Teaṁair .i. ḃloc aġur ḃluiċne, an ei ar a femoir, ar ro oirileir fṁir ġo o-ceiṫeaó an cairbaċ eaṫorra. Aġur bui Fal ann, feaṙb cluiṫe ro ainn aonaiġ an áṁbuiḋ. An ei ror raoṁaó plaiḋ Teaṁpaċ, oo ġlaoḋaó an Fal fṁir ronnaó an cappaṫ conio g-cluineaó caṫ. An ei naṫ upsoṁaó plaiḋ Teaṁpaċ, ni arplaiceir riaṁ na ṫa liaiġ .i. ḃloc aġur ḃluiċne. Ar e maó eiṫeaó eaṫaiṙ laiṁe eorpa; aġur an ei naṫ upsoṁ plaiḋ Teaṁpaċ ni fġneaó Fal fṁa ronnaó. Ni ar ro eaṫaiṙ Luġaiḋ Riaḃ n-ḋeaṙġ ṫar n-ġuin Eṁiṁġeoil.

D'eiṁġiṫ Conaire co Teaṁraiġ conа ouiṁiḃ aġur conа caṙbaiṫ na plaiṫ. Anair an cappaṫ conа eaṫoiḃ ar a cionn; aġur ġo g-caṫal inn piġe ir in caṙbaiṫ. Anṫaṫ na h-eiṫ an oi leiṫ ar cionn Conaire. Ir in caṙbaiṫ eaoe, ar a maṫair; Deiṫ Conaire inn; ár ro raoṁ an cappaṫ é. Ġaḃ iomoo, oon, ol ri, an caṫal. Ġaḃair uime ma ṫeaṫaiṁ ri riaḋ na fluaġaiḃ; ḃa coiṁri oo an caṫal. Deiṫ an cappaṫ roe, ar é 'na ṫeaṫaiṁ ann. Deiṫ oo chum Fail ġor na fluaġaiḃ uime, a maṫair riaṁ. Ġlaoḋaiġ an Fal aṙo ee Fal ror in fluaġ uile, fa meo an e-fluaġ baeṫaiṙ i o-Teaṁair each fṙiu; aġur ġiallaiṫe oo Conaire aġur oo ḃeṫaṫ coṁoṙbuṙ a aṫair oo.

chariot would not admit any person unworthy of the throne of Temur, and the horses would start at his presence; and there was a king's *casal* in the chariot, and it would be two large for any one unworthy of the throne of Temur. And there were two stones at Temur called *Bloc* and *Bluicni*, which used to open out so that the chariot of the worthy person might pass between them. And *Fal* was there, a rounded lump of a stone at the head of *Aonach an Charbuid*. And when the throne of Temur was to be ceded to the worthy person, the *Fal* used to roar at the motion of the chariot so that all heard. But when the person was not eligible to the government of Temur, the two stones *Bloc* and *Bluicni* did not open out before him. They were so placed as to admit the breadth of the hand only between them; and when the candidate was not eligible to the throne of Temur, the *Fal* would not roar to the motion of the chariot. In this manner they refused Lughaidh Riabhderg after the fall of Edersceol.

Conary went up to Temur to the chiefs and the kingly chariot. The chariot with its horses waited for him, the *casal* of the king was in the chariot. The horses on either side waited for Conary. "Into the chariot go," said his mother; Conaire did so, for the chariot received him. "Put on the *casal*," said she. He put it on in the presence of the multitudes; the *casal* was a fit for him. The chariot moved under him, while he stood in it. He went to *Fal* with the multitudes about him and his mother before him. The *Fal* roared to the hearing of all the multitudes who were at Temur; and they delivered hostages to Conaire, and gave him the coarbship of his father.—*The Book of Duald Mac Firbis*, p. 384.

Of these stones, two still remain; and are, probably, not far from their original locality. They are rudely-shaped obelisical pillar-stones, situated within the churchyard, and are pointed out by the people as the stones left there "by

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the giants of Tara." They are each about 2f. 6in. in height, and about the same in breadth.

To the east of these stones, according to the prose account, was situated *The Monument* of the Dwarf, but of which there are now no remains. This tomb is stated to have been three feet in length, on the first measurement, and three feet and a half on the second! To the understanding of this statement, it will be necessary to observe, that the miraculous power of this tomb to adapt itself to the size of every person is recorded in many ancient Irish poems and prose tracts, as one of the thirteen wonders of Ireland. In one of these poetical accounts called *Mirabilia Hiberniæ*, which is given in a Latin translation by O'Flaherty, the tomb of the dwarf at Tara is thus described:

> "Temoriæ Nani tumulum lapis obtegit, in quo
> Vir, puer, aut infans tres, et non amplius, æquat,
> Quisque pedes longo: numerum discrimine nullo
> Multiplicat, minuitve pedum proportio dispar."
>
> *Ogygia*, p. 290.

The same statement occurs in the Book of Ballymote, fol. 140, page *b.* col. *b.*, and is also thus given in an ancient poem on Tara, ascribed to Caoilte Mac Ronain, in the Library of Trinity College, H. 1, 15, p. 38.

Ꞇiġi an aḃaic a Ꞇeaṁraiġ,	The tomb of the Dwarf at Temur,
Ni ċuala inġna aṁlaiġ:	I have heard no wonder like it:
In uair do luiġ for in lic	From the hour that lay under the flag
Sen bec Seaġra, ua Eibric,	Little Sen of *Seaghais*, grandson of Eibric,
In fear ir mo d'fearaiḃ Fail	To the largest man of the men of Fail
An fear ar luġ in a ḋail	The smallest man along with him,
Cuerruime doiḃ ceaċtar de	Its adaptation to either of them
Ḋa d'inġantaiḃ na liġe.	Is of the wonders of the tomb.

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A similar legend is given by Nennius, in his tract entitled *De Mirabilibus Hiberniæ*, but in which the monument is stated to have been on *Crucmaur* in *Cereticum ;* and hence Sir James Ware considered, that it should properly have been placed among the wonders of England as it is found in some copies. But, however this may be, the absurdity of the superstition connected with the monument at Tara should not invalidate the fact of its former existence. The tomb of St. Coemgene, or Kevin, the patron saint of Iris Hier, one of the South Islands of Aran, is still universally believed by the people of the west of Ireland to have a similar miraculous power, a belief which no demonstration of its fallacy can shake.

It was in the immediate vicinity of these monuments, namely, in a mound, or bank, near the churchyard, that about the year 1810, the golden Torques were found, which are now happily saved from the usual fate of antiquities of the kind discovered in Ireland, by the liberality of the Members of the Royal Irish Academy, and other patriotic individuals. These Torques are of a spiral or screw pattern, as will be seen from the subjoined wood-cuts ; and though the design is simple, the workmanship is of great beauty. In both instances the twist is formed of four equidistant radiations from a common centre, subsequently twisted into this spiral form. The first is five feet seven inches from one extremity to the other, and weighs 27 oz. 9 dwts.

The second Torque, though of equal diameter, is of more delicate construction and greater lightness—the weight being only 12 oz. 6 dwts. A great dif-

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ference will be also perceived in the form of the thin rod, which springs from the extremity at one side.

Torques of similar size, and generally of the same pattern, have been frequently found in Ireland, and are often accompanied by *Armillæ*, or bracelets, of the same description. A model of such a Torque is preserved in the museum of Trinity College, and smaller specimens in gold may be seen in the cabinets of several collectors of Irish antiquities.

The term *Torques*, by which antiquarians usually designated these ornaments, is one of frequent occurrence in the classic authors, and is generally derived from the Celtic *Torc*, a twisted collar; or, perhaps, more correctly, a twisted circular ornament of any kind, as the ancient Irish called a collar, or neck-chain, *Muntorc*. And since the Latin verb *torqueo* has no cognate in Greek, it is probably formed from the same Celtic root.

Collars of this kind seem to have been common to all the Celtic nations, as appears from ancient writers. Livy tells us, that Publius Cornelius, in his triumph over the Boii, a Gallic nation, collected, among the spoils, no less than fourteen hundred and seventy *Torques:* and Propertius states, that Virdumarus, king of the Gauls, wore such an ornament. Dio Cassius notices a Torque of this description, as ornamenting the person of the British queen, Boadicea; and even within a few centuries of the present time, a Welsh prince was called Llewellin *aur dorchag*, or Llewellin of the Golden Torque. The Torques found in France

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and Wales are exactly similar to the Irish: a fine one found near Harlech, in the year 1692, is preserved in the Mostyn family in Flintshire.

It has been supposed by some antiquarians, that the use of these ornaments was derived from the Romans. But the great number discovered in Ireland is opposed to such a conjecture; and they may, perhaps, with much greater probability, be referred to a Celtic origin. It does not appear, that they were generally worn by the Romans; and the very appellation, *Torquatus*, which was bestowed on Titus Manlius, from the golden Torque taken by him from a Gaul, whom he slew in the year of Rome 393, and which was continued as a surname in his family, seems to indicate, that the *Torques* was not familiar to the Romans at the time.

The Torques of the Irish are spoken of in the most ancient MSS. under the names of *Mun-torc*, and *Muinche*, or *Moinche*, by which they were also called. Thus, in a description of the person of Cormac Mac Art, in the Book of Ballymote, fol. 14, *b* 2, it is stated, that he had a fine purple garment about him; a golden brooch in his breast; a *Mun-torc*, or collar of gold, around his neck; a belt ornamented with gold and precious stones about him, &c. "Ḃṗaṫ coṁcṙa caṙleaćća uime; liaġḋelg oiṙ roṙ a ḃṗuinḋi; MUN-TORC oiṙ im a ḃṗaiġiḋ; criṙ óiṙ go n-gemaiḃ ḋo liġ logmaiṙ Ṫaiṙiṙ," &c. And again in H. 3. 18, p. 391, in the MS. Library of Trinity College, a distinct allusion seems to be made to the lumps usually found at the extremities of the Torques, as in the Tara examples: Ḋa uḃall* óiṙ roṙ ḋe gaḃal a muince, meḋ ṙeaṙḋaṁ each n-ae;" that is, two *apples*, or balls, of gold on the two forks of his *moinche*, each the size of a man's fist.

The following curious reference to the golden Torque of Dermot Mac Cearbheoil, the last king of Ireland resident at Tara, is found in the life of St. Brendan, preserved in the *Codex Kilkenniensis* in Marsh's Library, fol. 60.

"Venit aliquando sanctus Brendanus visitare sanctos in regione Midi manentes. Tunc Diarmoyt filius Cearbuyll rex Hibernie qui regnabat in urbe *Themoria* in regione Midi sompnium vidit .i. duos angelos *torquem regiam* de collo ejus tollentes et dantes homini sibi ignoto. Crastino jam die, pervenit sanctus Brendanus ad regem illum: eumque vidisset eum rex dixit amicis suis;

* It should be observed, that in Irish MSS., as well as in the spoken language, the word *abhall* (apple) is applied to any knob or rounded termination.

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hic est vir ille cui vidi *torquem* meam dari. Tunc sapientes dixerunt regi. Regnum Hybernie usque nunc erat regibus; a modo dividetur inter sanctos Hybernie regnum tuum O Rex. Et hic sanctus magnam parrochiam per Hyberniam habebit. Hoc somnium et interpretacionem ejus audiens sanctus Brendanus ait ad omnes. Ita erit, quia Deum colentibus hic et in futuro bona dabuntur, ut est illud: Querite primum regnum Dei et alia bona addentur vobis. Et Rex Diarmoyt honorem dedit sancto Brendano, justi tenax enim et Catholicus erat ipse rex."

Though the name of the original wearer of the Tara Torques is, perhaps, now lost beyond the possibility of recovery, yet the certainty of their locality invests them with a high degree of antiquarian interest, and goes far towards determining their antiquity, which, there can scarcely be a doubt, is at least anterior to the desertion of Tara, in the sixth century.

The monuments next noticed in the prose account, as being in the immediate vicinity of the Grave of the Dwarf, and north of the Rath of the Synods, are the mounds called *Dall* and *Dorcha*—the tombs of the two blind mendicants so named, who slew each other. The accounts of the situation of these monuments, as given both in the prose and verse, are very indistinct; the prose, as given in most copies, states, that they were to the north of the Dwarf's Grave, *Dall* towards the south, and *Dorcha* towards the west; or, as given in the Book of Glendalough, *Dall* the name of the western mound, and *Dorcha* the name of the eastern. From the indistinctness and apparent contradiction in these accounts, it is not possible to assign, with any degree of certainty, the proper names to the two mounds, which still remain to the north and north-west of the Rath of the Synods; but there can be but little doubt that they are the mounds alluded to, as otherwise they would be unnoticed features in all the descriptions.

The next existing monument, which these records identify with certainty, is the *Teach-Miodhchuarta*, or Banqueting Hall, so celebrated in Irish history and tradition. Of this building, the verse only states, that it was called Long na Laech—the House of the Heroes; Barc na m-ban—the House of the Women; Teach na Laech—the House of the Heroes; and adds, that it was no weak house, and that it had fourteen doors. The words *long* and *barc*, applied by the poet to this edifice, both which literally signify a ship, have evidently a figurative reference to the long shape of the building, a form very rare in Ireland, and of which this hall was probably the first instance previously to the introduction of Christianity into the country. The word *long* is explained by Cormac Mac Cul-

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lenan as a ship—"*ab eo quod est longa*;" and again, "Long .i. Saxanbepla, i. e. lang .i. paba, *et inde dicitur* Long."—a ship.* The prose account describes with great accuracy its situation and form. *Long na m-ban*, i. e. *Teach-Miodchuarta*, lies to the north-west of the eastern mound. Its ruins are situated thus: the lower part to the north and the higher part to the south, and walls are raised about it to the east and to the west; the northern side of it is enclosed and small; the lie of it is from north to south. The *fuath* (foundation) of this long house has twelve doors upon it, or fourteen, seven to the west and seven to the east. It is said, that it was here that the *Feis Teamhrach*—meeting or assembly of Temur—was held, which seems true, as so many men would fit in it as would form the choice part of the men of Ireland. This was the great house of the thousand soldiers.

The situation of this ruin is on the north slope of the hill, and its lie, or direction, is very nearly north and south. Its length, taken from the road, is 759 f., and its present breadth at the bottom is 46 f., but its original breadth must have been about 90. The accompanying section, which is from south to north, and on a scale of 150 f. to an inch, will shew the slopes and measurements of the length of the building as at present remaining; but the original length must have been greater, as the northern end appears to have been cut away by the road.

It will be seen, that the bottom of the Hall has not a regular slope from the

* He elsewhere derives the word long, a ship, from the Latin *longus*. "Long bir por muip, *ab eo quod est longa* .i. *lang* .i. poca .i. poca bir por muip." i. e. *Long*, that is on the sea, *ab eo quod est longa*, i. e. *lang*, i. e. long, i. e. it is long on the sea. Whether Cormac be right or not in his supposition that the word *long*, as applied to a ship, was derived from the Saxon, it is probable that *long*, as an adjective, must have been an original word in the Irish, as a branch of the Indo-European family of languages; and it appears even to have been applied to a ship at a very remote period, from the epithet *Loingseach*, mariner, applied to Labhra, an Irish monarch, who led a Gaulish colony into Ireland before the Christian era.

south to the north. The section from east to west, which is on a scale of 60 f. to an inch, shews thus :

From these sections, as well as from the ground-plan on the map, it will be seen that in the preceding accounts of this building there is nothing stated which is not fully corroborated by the ruins still existing; and it may be again remarked, as a curious proof of the accuracy of the prose description, that the uncertainty as to the number of doors being twelve or fourteen remains a difficulty at the present time.

There is, however, another ancient account of this building, also preserved in the *Dinnseanchus*, which enters into details more likely to awaken scepticism, namely, the poem of Kineth O'Hartigan, written about the middle of the tenth century; and, certainly, if the object of this investigation were any other than the discovery of truth, it might, perhaps, be most prudent to follow the example of the Irish literati, by allowing it to slumber in the darkness of its ancient language. But as this document is the sole authority from which the Irish writers of the two last centuries have drawn their startling accounts of the magnificence and splendour of the regal palace of the Irish monarchs, it is necessary that its statements should be exposed to rational investigation without any partial suppression, or mutilation; nor should those parts, which receive corroboration from existing circumstances, be hastily rejected in consequence of their being associated with traditional details dressed in the garb of bardic exaggeration, and which, viewed even as fictitious, are still valuable as evidences of the notions of civilization prevalent at the time.

It must, indeed, be confessed, that while the garbled extracts hitherto given from this poem have helped to bring the early Irish authorities into disrepute, they have also led to conclusions which it by no means authorizes. A remarkable example of this result occurs in the second volume of Mr. Moore's able history of Ireland, incomparably the best which has yet appeared. In recording the death of the poet, Kineth O'Hartigan, Mr. Moore adds: "A poem of this writer is still preserved, descriptive of the beauty of the celebrated hill of Tara,

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and moralizing mournfully over its history; nor should those who visit, in our days, that seat of long extinguished royalty, feel any wonder on not discovering there some vestige of its grandeur, when told, that even in the time of this poet, *not a trace of the original palace still remained;* while the hill itself had become a desert overgrown with grass and weeds."—p. 132.

It will be seen, however, that this statement, which would completely nullify the accounts given in the preceding pages of this memoir, is not substantiated by any passage in the poem.

It should be remarked, that in the following translation the various copies have been compared, and that of these the best is preserved in a MS. in Trinity College, H. 3. 3, transcribed in the sixteenth century, at *Ard Choill* in the county of Clare, for the celebrated historian and poet, John O'Mulconry. It is from this copy the text is here printed; but, as the various readings in the other copies will be given in the notes, it will be proper to prefix a list of the several copies referred to, with their present localities. The first is in the Book of Glendalough, class H. 2. 18; the second, in the *Leabhar Buidhe Lecain*, H. 2. 16, p. 403: these two MSS. are in the Library of Trinity College. The third is in the Book of Ballymote,—fol. 189, p. *b.* col. 1; the fourth, in the *Leabhar Gabhala* of the O'Clerys: both of these are in the Library of the Royal Irish Academy. It will be proper also to premise, that from the great obscurity of the language, and the differences found in the readings of this poem in these several copies, it is not always possible to decide on the most correct reading, or to convey, with any great degree of certainty, the author's original meaning. But the general sense, as far as history is concerned, will at least be preserved, as on this point no material difference occurs in any of the copies, and particularly as an ancient Gloss on this very poem has been found in the College Library,—H. 3. 18, p. 467.

Suiðiugaiḃ Tiġi Miogusṙeo ann ro rior
buo ḃerail.

The situation of *Teach Midhchuarta* here follows.

Tech Miogusṙea[1] imorro an aṁrir Cormaic h-Ui Cuinn: eri ceo eroiscid a comur an eiġe rin, ocus xii. cubaic a rad an

Teach Midhchuarta in the time of Cormac O'Cuinn: three hundred feet [was] the measurement of that house, and seven cubits the

[1] Teach Mioḃchuarta imorro i Teamraiġ, &c.—*L. Gabhala* of the O'Clerys.

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ceillaiġ, ocur peche comeolbpuiġ ṙ·in bpuiġ-in ṙin.[7] Da peche n-oopuṙ ṙopṙ in ṙi-tec ṙin. Tṙi caecad imdaiġ imba imdaiġ Cop-maic; tṙi caecad laeċ in ġaċ imdaiġ. Caecad pecaiṙi ac Copmac. Caecad laeċ ino a ṙeṙam i ṙiġnuṙe and piġ in ceim a biṫ ic caiṫeṁ. Tṙi caecad ṫeilium ir in dun ṙin. Tṙi caecad ṫeabai a capmocol, ocur o'aṙcaḋ, ocur d'or. Caecad ar mili ṁe a n-airiom eeġlaiġ an piġ ṙin.

Cindoḋ h-Ua Aṙeaġain *cecinit*:[8]

Doman duḋain[9] alainne!
Comol[10] caiṙi ceo cuiṙi,
Dṙecc ilur laiṫ[11] ṁa labṙaḋ,
Ace aṙaḋ ṙi na n-uili.
Ro ṙaiṫ ceo ṁeche imṙaad,[12]
Ro ṙaiṫe ceċ ceṙṫ co ġṙiaan;[13]
Temaiṙ, aniu cio ṙaṙaḋ,
Doi ṙan[14] ba naṙaḋ[15] niaṁ.
Ro ba blaiṫ a ṫoṙ[16] caebaḋ,

length of the fire-place, and seven chandeliers in that palace. Twice seven doors in that royal house. Three times fifty *imdhas* besides the *imdha* of Cormac; three times fifty heroes in each *imdha*. Cormac had fifty lawgivers. Fifty heroes stood up in the presence of the king while he was eating. Three times fifty cup-bearers in that *dun*. Three times fifty goblets of carbuncle, of silver, and of gold. Fifty above a thousand to be enumerated the household of that king.

Kineth O'Hartigan *cecinit*:

World of perishable beauty!
The banquet of a hundred parties,
False the many solemnities to mention,
But the adoration of the king of all.
Every law of fame has passed away,
Every justice destroyed to the ground;
Temur, to-day though a wilderness,
Was once the meeting-place[11] of heroes.
Fair was its sided tower,

---

[7] Righ tig.—*L. Gabhala.*

[8] Headed in the Book of Ballymote thus: Cindeo h-Ua Aṙeaġain *hoc carmen cecinit* do ṙuidiġeḋ tiġe Copmaic. i. e. Kineth O'Hartigan composed this poem on the situation of the House of Cormac. In the Book of Glendalough, however, this poem is ascribed to *Cormac Fili*, a poet of the same century.

[9] Duḋain, mortal, perishable, is the opposite of ṙuḋain. Many Irish words, beginning with ṙ, form their opposites by changing ṙ into d, as ṙona, dona; ṙolaṙ, dolaṙ; ṙuaiṙc, duaiṙc; ṙoṙḋa, doṙḋa, &c. &c.

[10] In H. 3. 18, p. 640, this line is explained as follows: comol .i. ceangal; *ut est*:

Doṁain duḋain alainne, Comol caiṙe ceo cuṙe,
Dṙeġ ilur laiṫ ṁe labṙa, Ace aṙa piġ na n-uile.

In H. 2. 16, p. 403, this line runs thus: Comol caeṙi ceo cuiṙi.

[11] In a gloss on this poem, preserved in H. 3. 18, p. 533, the word laiṫ is explained by ṙollumain, a festival or solemnity, and this verse quoted.

[12] Ac chu caċ ṙeċe imṙoro.—*Book of Glendalough.* Ro ṙaiṫ cech ṙeache maṙṙaad.—*L. Gabhala.*

[13] Dechiu ceṙṫ co ġṙiaan.—*Book of Glendalough.* Ro ṙcaiṫ ġach ceṙṫ co ġṙiaan.—*L. Gabhala.*

[14] For ṫan the *L. Gabhala* has ṙé, with which it is perfectly synonymous.

[15] In H. 3. 18, p. 467, the word naṙaḋ, in this line, is glossed ġnáeḋaiġeḋ.

[16] Cluṫi, no oenaċ, no aurcaċ, ir ḃo ir ainm Naṙṙuḋ. A game, fair, or meeting, is called *Nassadh.*—*Cormac's Glossary.*

[17] Nir bo ṫṙaiġ a ṫoṙe coebaċ.—*Book of Glendalough.*

Dían bo h-aonaċ ṙoṙ ṙoelaiġ,[13]
Dá mop n-dam dían domġnap,[14]
Ániu ciá ronn ġlaṫṫ ṙeapaiġ,
Dá dind n-oiṙdniġe n-imġlic,
Dá roiṙcelaiḋe co m-biaḃ-ṙlaiṫ:[15]
Ria cuiḃṙin ba dṙuim n-oiṙḋoeṙc,
An aimṙip h-Ui Cuinn, Copmuic.
Dia m-boi Copmac ṙo clochaiġ,
Dá ṙel, ṙo blad a peaṫa,
Ni ṙṁiḋ dun amail Temaṙ;
Ro b'e ṙun belaiġ beaṫaiġ.[16]
Daile a bṙiġ ṙin uaṙ buiḋnib,
Ino piġ ṙin oo ġab Temṙuiġ:
Is ṙeṙṙ duinn, coluiḃ ṙine
Cuiṙim, a eiġhi ceoġluiġh.
Nai cluin, no cluiḋeaḋ ġaṙḃdeann,[17]
Za nai n-oumaᵉ⁵ 'n a eimceall,
Re ṙino aiṁbeṙe na ṙinncṙann,[18]
Caṫaṙ imaṙoeṙc imeenn.
A ṫech moṙ milibh amuiṙ,

At which was the meeting[13] of heroes of story,
Great was the host to which it was inheritance[14],
Though to-day a green grassy land,
It was a famous *dinn*[17] of wisdom,
It was noble with warlike scions:[15]
To be viewed it was a noble hill,
In the time of O'Cuinn, Cormac.
When Cormac was in his glory,
Conspicuous, famous his motions,
No *dun* was found like Temur;
It was the secret of the road of life.
Strong the vigor of him over hosts,
Of that king who took Temur;
It is better for us, the many tribes
To reckon, the fair multitudes of his household.
Nine *cluids*, or rough, strong ditches,
With nine mounds around it,
With the fair *airbert* of the fair trees,
A famous, strong *cahir*.
His great house of a thousand soldiers,

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[13] Dían b'aenaċ ṙoiṙ ṙoelaiġ.—*Book of Glendalough.* Ṫep bo aenach ṙoelaiġ.—H. 2. 16. Ciap bo, &c.—*L. Ballymot.* Ṫep bo.—*L. Gabhala.*

[14] Aonaċ is now understood to mean a fair, but in ancient Irish MSS. it is used to mean any meeting of the people.

[15] Socaiṫ diap bo domġnaṙ.—*L. Ballymot.* Daoi mop n-dumh diap bo domġnaṙ.—*L. Gabhala.*

[16] Domġnaṙ, also written doṁġnaṙ, signifies dominion, inheritance. In a poem in the Book of Lismore the sea is called doṁġnaṙ Neṙenn, the dominion of Neptune, which places the meaning of the word beyond dispute.

[17] For the meaning of dinn, see page 135, note §.

[18] Dá ṙono n-oiṙdniġi n-imġlic, ba boṙġḃile co m-blaṫ blaiṫ.—*Book of Glendalough.*
Dá dind n-oiṙdniġi n-imġlic, baṫ roiṙġḃi co m-blaṫ loiṫ.—H. 2. 16.
Dá dind n-oiṙdniḃe n-imġlic, dá boiṙġḃiṫe co m-boou-ṙlaiṫ.—*L. Gabhala.*

[19] Diaḃ-ṙlaiṫ, warlike scions. Diaḃ is the *Bellona* of the pagan Irish, and hence young warriors are poetically called scions of *Bellona*, diaḃ-ṙlaiṫ.

[20] Da ṙi ṙun belaiġ beaṫa.—*Book of Glendalough.* In the Glosses on this poem, preserved in H. 3. 18, pp. 467 and 533, belaiġ beaṫa is explained beoiṫ beaṫa, the passage or opening of life.

[21] Noi cluiṫe niṙ clui ġaiḃṙeṙno.—*Book of Glendalough.* Nai cluiṫe no clui ġaiḃṙeeano.—*L. Ballymot.* Naoi ecluiḃ, no cluiḋa ġaiḃḋeenn.—*L. Gabhala.*

[22] N-dui.—*Books of Glendalough* and *Ballymote.*

[23] In aiṁbiṙe na ṙinoclann.—*Book of Glendalough.* Le ṙionn-aiṁbeṙe na b-ṙinoclann.—*L. Gabhala.*

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Con dinnḃ, nip bo dolurr,[24]	With tribes, it was not sorrow,
Caḋair glan glerib[25] glainfer,	A fair bright *cahir* of fine men,
Tri cee fraxeo a fomur.	Three hundred feet its measurement.
Nip cairmḋell[26] bairi burbae,	It was not a circle of ignorant folly,
Na cumga gairri gargai;	Nor a narrowness of austere wisdom;
Nip bo po beg fri cherba,	It was not too small for separation,
Se coic cubae a h-aroiei.[27]	Six times five cubits its height.
Roba rig, ri uar finni,[28]	Habitation of a king, king over Erin,[29]
Forr n-dailte fion co finni.[30]	In which was distributed wine with brightness.
Da dion, ba dun, ba dingna,	It was a *dinn*, a *dun*, a *dingna*,[31]
Tri caeçao imdaigh inneee.[32]	Three times fifty *imdhas* in it.
Di coeca laech co laimiḃ,	Fifty heroes with swords,
Nip uo broce braeḋ ar bruicein,	Our city was not a silly city,
Da he luce linḃ oinecha,	Were the inmates of the *dingna*,
Ceċa h-imdaiġ di ruiḋibh.[33]	In each *imdha* of these.
Ro b' ailainn in flaġ ramlaiḃ,	Grand was the host thus [stationed],
Taiṫniom ar ar a naḋnaiḃ,[34]	The glittering of gold upon their weapons,
Tri caeçao airel erenaiḃ,	Three times fifty splendid *airels*,

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[24] Co n-dainib nip bo donur.—H. 2. 16.

[25] Glere.—*L. Gabhala.*

[26] "Cairmceall .i. cimḋell."—*O'Clery.*

[27] These two quatrains, from "A rech mor milibh amurr," to "Se coic cubae a h-aroiei," are omitted in the Books of Glendalough and Ballymote.

[28] Roba in rig, ri uarannd.—*Book of Glendalough.* Roba rig ri uarranod.—*L. Ballymot.* Roba Rig, Ri uar roinde.—*L. Gabhala.*

[29] Ri uar finni. This ancient phrase is thus explained by O'Clery: Rinne .i. Eirinn: rig or Rinne .i. rig or Eirinn.

[30] Co a n-dailei fin co finde.—*L. Ballymot.*

[31] For the meanings of these words see page 135, note §. They are, however, so nearly synonymous that it is not often possible to discover a peculiar meaning in one distinct from the others.

[32] Inde.—*Book of Glendalough.* Uime.—*L. Ballymot.* Imi.—H. 2. 16. Inne.—*L. Gabhala.*

[33] Tri coicait laeċ collaine, Nip bo borg ar bruiġin, da ré luċe linaiḃ oinogna. Caċ imoa de ruiḋib.—*Book of Glendalough.* Dini caeca laeċ co laimiḃ, Ro bo broc baeċ ar bruiġin, he a luce linib oingna, Cuca imoa do caigib.—*L. Ballymot.* Dao caeca laech co laimiḃ, Nip bo borb baech ar bruigin, da hé a luce limib oingna, Gaċ imoa di ruiḋiu.—H. 2. 16. In the margin of this MS., po ba is given as a different reading for nip bo. Doi caeca laech co laimiḃ, Nip bo broġ baech ar bruiġin, da he luche limib oiongna, Cecha h-iomoa di ruiḋib.—*L. Gabhala.*

[34] Taiteneo oir or a airel, i. e. the glittering of gold over his bed.—*Book of Glendalough.* Taiteneo or ar a oingnaib.—*L. Ballymot.*

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Cuoca in ceć aipel inmain.[35]	Fifty in each agreeable *airel.*
Seche cubuc cinoać cunboil,	Seven cubits without any sparingness,
Fiaó in baim, þþonꝯ þeim,[36]	(Before the host, people of exertion,
Fri h-aónaó puerall polup,	For lighting the flambeau of light,)
Óa he comup an cellaech.	Was the measurement of the fire-place.
A þeche naili, po cualae,	Seven also, I have heard,
Fri cepe n-glaine, cen e-penaie,	With perfect brightness, without denial,
Segoi, ranneiṁlai, raopa,	Splendid, beautiful, noble,
Caoma cainnelbpai cpeóaie.	Fair chandeliers of brass.
An caéair gnianach, glan rin,	That sunny, fine city,
Fleoach, ianach,[37] co roinrib ;	Of feasts, of goblets, of springs ;
Innei fa poicle polup,	In it joyous was the light,
Óa þeche n-oopurr oi boirrib.	Twice seven doors of doors.
Óa he oligeaó ano riġ rin,	It was the law of that king,
Ol nop nibió[38] an floġ rin,	To drink before that host should drink,
Óa meo, mop mop in lan rin,	Great, very great that number,
Tri ceo ol ir ino ol rin.[39]	Three hundred drinkings in that drinking.
Cuoca peċaire raṁoa,[40]	Fifty noble lawgivers,
Lap an flaith folca, fiaṫaċ,	With the noble, upright prince,
Cuoca por fleoaé, finglan,	Fifty also truly fine, festive companions,
Za coecai þriṁlaoé þriṁoa.	With fifty chief distinguished heroes.
Cuoca laoch[41] ino a þeraiṁ,	Fifty heroes standing up,
Conooiteir an raol roraiṁ,[42]	To attend on the warlike king,

[35] In the Glosses on this poem, preserved in H. 3. 18, pp. 467 and 533, this quatrain is quoted as an example of the words aipel and binġnaiḃ: Aipel .i. imbai, *ut est:*

Rob' alainn in floġ ramlaiḋ, éaineṁ ap a n-binġnaiḃ (.i. ap a flegaiḃ)
Tri coecae aipel epġnaiḋ, Coecao in ġac aipel inmuin.

The last line of this quatrain is thus given in the *L. Gabhala:* Cpoccao in cech aipel niomouiḃ ; and in H. 2. 16, the last word in this line is written bimoaiḃ.

[36] Seċt coicaie can naé connail, Fiao in baim n-oponꝯaiḋ n-oṙennoiġ.—*Book of Glendalough.*
Seċt cubaio ceanbach conoail, Fiaoi an baim oponꝯuiġ oṙeambaic.—H. 2. 16.
Seache cubar cennach conbail, Fiaoa an baim oponꝯaé oṙemeaiḋ.—*L. Gabhala.*

[37] Ianach.—*L. Gabhala.* Fianach.—*Book of Glendalough,* and H. 2. 16.

[38] Nop n-ibeaiḃ.—*L. Gabhala.* Ol ap n-ibeo.—*Book of Glendalough.*

[39] These four quatrains, from Seche cubuc, &c., to Tri ceo ol, &c., are omitted in the Book of Ballymote.

[40] Ramoa.—*L. Ballymot.*

[41] Caoca peap.—*L. Ballymot.*

[42] Connoiteir in rael roraiġ.—*Book of Glendalough.* Conneeir in rael roraiġ.—*L. Ballymot.* Conemir in raol roraiġ.—*Gloss in* H. 3. 18, p. 467. In this Gloss the word conemir is explained by co rnieéolaiṙ, i. e. That they might attend on. Conóġaiṙ an rael roraiṁ.—*L. Gabhala.*

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Cén bioo anopi gи ac ool,[41]	While he was feasting,
Ар na ba doaoh dopram.[42]	That no mischief might befal him.
An uall noioec pia n-uabup,[43]	The harmonious shouts of pride,
Na puipeć puaó, na painpep,[44]	The valiant chiefs, the mighty men,
Ni oae oimoaiġ oon aipeṁ.[45]	It is not unpleasant to enumerate them.
Tpi cec oailem nop oaileó.[46]	Three hundred cup-bearers distributed.
Tpi caeca peaba[47] coga,	Three times fifty choice goblets,
Piaó cec oaim, colai cuile,	Before each party, of great numbers,
Sec ba capprnocal n-glan m-balc,	Which were of pure strong carbuncle,
ba hop, ba harpcao uile.	Of gold, or of silver all.
Tpi coeca coicea n-gulach,	Three times fifty stout cooks,
Cenaċ nannac, fri fuipec,	Without any anger, in waiting,
Fri h-aipep cenoaċ coloć,	With food in great abundance,
Na riġ rogaé na puipeć.	Upon the great kings and chieftains.
ba mo oon mal ba moo,	This greatest prince had a greater,
Ar cec loo ba liaı,	Every day a greater number,
Tpica cec, noć no puipgep[50]	Thirty hundred, were supported
Mac Airc euipneo ceć oiba.	By the son of Art each day.
A roponce filio ba fipoa,	His train of poets were upright,
Cuingoip oliġeaó a n-oala,[51]	They kept the laws of Ireland,

[41] Cein bia in pí ac a ol.—*Book of Glendalough.* Cen bioó an Ri acc oal.—*L. Gabhala.*

[42] Ar nabbao doad dorrom.—*Book of Glendalough.* Ar na ba dood dorum.—*L. Ballymot.* Ar na ba doad aorarh.—*L. Gabhala.* Conabad dodd dorom.—H. 2. 16.

[43] A nol nuag fri uabup.—*Book of Glendalough.* Nuall, &c.—*L. Ballymot.* An uall nuiveach fri h-uabar.—H. 2. 16, and *L. Gabhala.*

[44] Na puipeaé puam na paipeaó, &c.—*L. Ballymot.* Na puipeach puad na painpear.—H. 2. 16.

[45] Ni bo oimoalo in aipem.—H. 2. 16. Nir boo oimoaiġ oia n-aipeaṁ.—*L. Gabhala.*

[46] Tpicha oalem nop oailed.—*Book of Glendalough.* Tri caeca ro oor oailead.—H. 2. 16. Caocad oailem nor oailead.—*L. Gabhala.*

[47] Noi coicaie peaba poga, ba ri oal coga a cuile.—*Book of Glendalough.* All the other copies agree with the text as given above. In the Glosses on this poem, preserved in H. 3. 18, pp. 467 and 533, the word peaba is explained by the modern word roiġéeć, a vessel, and the above quatrain quoted as an example, thus :

Tri peaba oo gaé riġ oala cuile, Seć ba copmogal glan mac, ba hop, ba harpgao uile.—p. 467.
Tri coeca peaba coga oo gac oaiṁ, colai cuile pec ba copmogal glan mac, ba hop, ba harpgae uile.—p. 533. Seaba is also explained in Cormac's Glossary by the word leipeṁ, a vessel.

[50] All the other copies agree very nearly with the text, except the Book of Glendalough, in which this quatrain runs thus : Da hám oo'n mál ba mou, Ar caé lou ba lia, Tri mile ba nairmec, Mac Airc eipneo caé oia.

[51] This line is explained by Michael O'Clery thus : Cuingoir .i. oo éongbaioir na opaioir : "cuingoir oliġeaó nalla .i. oo éongbaioir oliġeaó a Éireannaiḃ."

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Ocup ni baop ci ao bepa[52]	And what they said was not folly
Co n-aop cena cec oana.[53]	With the professors of each art.
Tuipmim eaglaé na eolaiß	I enumerate the household of the hosts
Tize Tempaé oo oinibh ;[54]	Of the house of Temur of tribes ;
Ip e po an aipiom pipe,[55]	This is the true enumeration,
Caoca ap mile oo mhilibh.[56]	Fifty above a thousand of heroes.
Oia m-boi Copmac a Temair	When Cormac was at Temur
Ci po blaó uap gaé pogein ;[57]	His great fame was over every select one ;
Rig aiczen mac Aipe Aimpip[58]	A king like the son of Art Ainfir
Nip cim oo oaoinib oomain.[59]	There came not of the men of the world.
Copmac co caime cpoicha,—	Cormac of the fair form—
ba poca connbalc plaéa[60]—	A pillar of a mighty king—
Zenip o Echeaiß, imgil,[61]	He was born of Echthe, the fair,
Mac oo ingin Uilccaicheee.[62]	He was son of the daughter of Uilcaiche.
O boi Solaṁ fri pριιoo,	Since Solomon was inquiring,
Fep gaé cinie oo comol,[63]	A man who united each tribe,
Cein buo com maiie fri Copmac,[64]	An offspring as good as Cormac,
Ci De, in copmole an oomain ?[65]	O God, has the world consumed ?

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[52] Ocup ni baip ceo ao bepa.—H. 2. 16. Ocup ni baep cia ae bepa.—*L. Gabhala.*

[53] The last word in this line is defaced in H. 3. 3, but is supplied from the other copies. In the Book of Glendalough the quatrain is given thus : Ceno opong fileo fo fριnaa, Saigoip oligeo a n-oala, Ip oeip ni baep ci ae bepa, Cenar chena caé oana.

[54] In the Gloss on this quatrain, preserved in H. 3. 18, pp. 467 and 533, oinib is explained by aipeṁ. For oinibh, H. 2. 16, has oainib, and the *L. Gabhala* oaoinib.

[55] Ip e peo an e-aipeam fipi.—H. 2. 16. Ar é po an e-aipeṁ fipe.—*L. Gabhala.*

[56] This quatrain is given thus in the Book of Glendalough : Cuipmem eaglaé i n-oalaib, Taige Tempaé ó oinib, Ipp hi peo an aριm fipe, Tριéa mile oe milib.

[57] Ar po blae uap caé pogail.—*Book of Glendalough.* Ci po blae uap gaé pogain.—*L. Ballymot.* Ci po blaó op gaé pogain.—H. 2. 16. Ci po blaó op gaé pogain.—*L. Gabhala.*

[58] Rig aogein mac Aipe Aenpip.—*L. Ballymot.*

[59] Ni ppié oe oainib oomain.—*Book of Glendalough.* Nip cim oainib oomuin.—*L. Ballymot.*

[60] ba poeha ponobalc plaéa.—*Book of Glendalough.* ba poéa ponnbalc.—

[61] Zenaip o Echeaiß imgil.—*Book of Glendalough.* Zenaip o Eaicheże pinngil.—*L. Gabhala.*

[62] Uilcacha.—*Book of Glendalough.*

[63] Fepp cach cinuo fri comul.—*Book of Glendalough.* Fep cech cinn oo chomal.—*L. Gabhala.*

[64] Zein bao éummа fri Copmac.—*Book of Glendalough.* The word Cein in the text is evidently an error of the transcriber for Zein, as appears from the more ancient MS., the Book of Glendalough.

[65] Ci oe in copmalc ooman.—*Book of Glendalough.* Ci Dhe an ecopmalc an oomain.—*L. Gabhala.* The two last quatrains of this poem are wanting in the Book of Ballymote, and in H. 2. 16.

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It would be absurd to receive as a historical evidence, a bardic poem which only pretends to record the floating traditions of circumstances more than six hundred years anterior to the period of its composition; neither should a document of such undoubted antiquity be wholly rejected as a poetic fable, without some inquiry as to the possibility of its having at least a groundwork of truth—and particularly if in those statements respecting the size, &c., of the buildings, which the existing ruins enable the investigator to test, they should not be found wanting in veracity. Now it is remarkable that the only disagreement between the measurements of this building, as given in the poem, and in the present remains, is that the latter are actually more than twice the length stated, namely, near eight hundred feet; for respecting its alleged height there is nothing to awaken scepticism; and even the apparent disagreement just noticed may be explained by a plausible if not natural conjecture. Those measurements may be true as applied to the Hall, or Place of Assembly, while the remaining space on each side might have been occupied by apartments of lesser importance; and, indeed, the triple names applied by the poet to this building seem to require such a subdivision, for the Hall of Assembly could scarcely be called with propriety the House of the Women, nor the House of the Fians, or common soldiers. At all events the disagreement, such as it is, does not tend to stamp the poem with the character of exaggeration; and its statement of the number of persons, which this "great house of a thousand soldiers" was capable of accommodating, is well supported by the cautious remark of the prose account, that it would seem true, for, that as many men would fit in it as would form the choice part, that is, the chiefs, of the men of Ireland. It is not easy, however, to avoid considering as a poetic fiction the statement of the number of one hundred and fifty resting or sleeping apartments, with fifty soldiers in each—or in all seven thousand five hundred—which sleeping places are stated to have been about or around the house; yet it is evident that considerable accommodation must have been necessary for the military attendants of the provincial and other princes who came to the assembly; and it may not perhaps be puerile to remark, that a very ample space on each side of the Hall, and in which such apartments may be supposed to have existed, was unoccupied with any monumental remains at the time when the descriptive accounts were written. Such apartments were evidently of timber, and therefore no vestiges would be found

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in succeeding ages. The statement respecting the hundred and fifty drinking vessels of carbuncle, gold, and silver, and the seven brazen lamps, or *candelabra*, will be received with still greater incredulity. Yet even this statement will not be regarded as wholly fabulous by those who have seen the magnificent gold ornaments, now in the possession of the Academy, which were found within a few yards of this very spot, or the brazen vessels of more exquisite workmanship, and probably of higher antiquity, often found in Ireland, and of which there is a beautiful specimen in the Belfast Museum. Golden vessels have been frequently found in Ireland; and a passage in the Annotations of Tirechan, in the Book of Armagh, *fol.* 17, *b*, 1, affords an interesting evidence of their existence anterior to the introduction of Christianity. In adducing this passage it will be proper to state, that it has been copied (as indeed all the extracts hitherto given from that most valuable work have been) from the original MS., which has been most kindly placed in the hands of the writer by its proprietor, the Rev. Francis Brownlow. The passage runs as follows:—

Dippoggel* Cummen ocup ðpeðan Ocheep n-Achio co n-a ṙeilb, ɜeep ꝛio ocup maȝ ocup lenu, co n-a liup ocup a llubȝopt. Ogoiler om ou Chummin leeh in noṁi ro, in boim, in ouiniu, con piccaeap a ṙeuic ṙnie .i. *iii.* ungai apȝaiṫ, ocup cṙann apȝiṫ, ocup muince, *iii.* n-ungue co n-opoch oin pen-meṙb penaiṙoeib, logṫ leiṫ ungue oi muccoib, ocup log leiṫ ungue oi chaṙoib.

Cummin and Brethan purchased *Ochter n-Achid* with its appurtenances, both wood and plain, and meadow, with its fort and its garden. Half of this wood, and house, and *dun*, was mortmain to Cummin, for which they paid [from] their treasure, viz. three ounces of silver, and a bar of silver, and a collar, three ounces of the base gold of the old dishes of seniors, the equivalent of half an ounce in hogs, and the equivalent of half an ounce in sheep.

As to the cups of carbuncle, if the account be taken literally, it must of course be set down as romance; but the word carmogal, derived apparently from the Latin, is applied loosely by the ancient Irish to any shining stone of a red colour, such as the garnet, a production of the country; and the authentic annals record many gifts from Irish princes to the monasteries at an early period, of cups adorned with gems.

* Dippoggel, he purchased, is found in many Irish deeds and charters, variously written ouppogel, oo poiȝel, oopppogel, oo puaiȝel, and even oo puaccail. It is explained in O'Clery's Glossary by the modern words ceanaċ, no oo ceanaiṫ, i. e. a purchase, or he purchased.

† Loṫ, now written luaṫ, occurs frequently in the charters in the Book of Kells, in the sense of price, value, &c.

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In connexion with the ancient history of the *Teach Miodhchuarta*, there exists another ancient poem, which, from the curious and valuable illustration which it affords of the state of society in Ireland at a very remote period, should on no account be omitted in this memoir. Of this poem two copies are preserved in ancient vellum MSS., in the College Library; one, in the Book of Glendalough—a MS. compilation of the twelfth century, H. 2. 18; the other in the *Leabhar Buidhe*, or Yellow Book, of the Mac Firbises of Lecan, H. 2. 16. In both these MSS. the poem is illustrated by a ground-plan of the principal compartments of the house, with the names of the several ranks, professions, and trades, which were privileged to sit in them, and the order in which they were located—with the names of the different portions of the meat to which each was entitled. And, as the copies of this curious ground-plan are slightly dissimilar, and of different ages, fac-similes are given of both. Of the name or age of the writer of the poem no record remains, but that its antiquity is higher than that of any of the documents already given, and possibly anterior even to the desertion of Tara, will not be doubted by any person conversant with the Irish language; and indeed the obscurity of the language is so great, from the obsoleteness of the words, that the translation of it has been attended with the greatest labour and difficulty, and in several instances it has been impossible to determine with certainty the meaning of the names of the things described. An attempt to illustrate this singular remain was made by the late General Vallancey,—with what success may be judged from the translation here given. To the poem is prefixed a prose preface, giving descriptions of the House of Laoghaire, the House of Cormac, and the *Teach Miodhchuarta*, or Banqueting-Hall; and the accuracy of these descriptions is sustained by the existing remains of the monuments, nor indeed is there, either in the prose or verse, anything inconsistent with probability. It may, perhaps, be objected that no accurate accounts of this kind could have been preserved from so early a period as that anterior to the desertion of Tara, but that the use of letters was prevalent in Ireland very near, if not at, the time to which these descriptions refer, has been shewn in the earlier portions of this memoir; and from the poem of Cuan O'Lochain it appears that the customs observed at Tara were continued by the Irish kings in his own time.

> "There exist still people like them,
> With kings and with princes."

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And thus, even should its antiquity be questioned, this poem should still be received as an authentic illustration of the customs of the Irish in remote times.

Suiuṅgáð Tiġi Miḋċuarṫa. Ní caṫ ṗi laṗ ca[1] i n-ᵹu amail bae la Conn Ceṫ-ċaṫaċaiḃ, ocuṗ Teaċ Cormaiᵹ, ocuṗ Cairṗṗi Liṗeaċair, ocuṗ Teaċ Caṫaiṗ Máiṗ, ocuṗ Teaċ ᵹaṫ riġ ṗo ṗaiṫnea i Temraiġ co Niall Naᵹeallaiḃ,[2] aṗṗuiᵹeaḋ ṗo ḟiṗi, ocuṗ ṗo ᵹiall h-Eṗiu[3] oo ṗo ḟiṗi. Samlaiḋ bae ṫeaċ Laeᵹaiṗe Mic Neill, iaṗ ceiṫ, ṫreó ṗo ṗiaċe ḟiṁain eiᵹi Cormaiᵹ.[4] *ccc.* eṗaᵹeo hi ṫaiġ Laeᵹaiṗe; *l.* i mḃaiġ anns; *l.* ṗe[5] n ᵹaṫ i mḃaiġ; *l.* aiṗeṫ eiṫṗiḃ; *xx.* ṗeṗ in ᵹaṫ aiṗiuṫ. *Iiii.* cubaiṫ a ṫeaṫlaiġ; ocuṗ *ix.* cubaiṫ a ṗoiṗoléṗ; ocuṗ *xxx.* cubaiṫ a aiṗoi ṗuaṗ.[6] *Vii.* ṫreoiṁ[7]

The situation of *Teach Midhchuarta*. Each king who has it at this day does as was done in the time of Conn of the Hundred Battles, and [when it was] the house of Art, and of Cormac, and of Cairbre Liffeachair, and the house of Cathair Mor, and the house of every king who ruled in Temur to Niall of the Nine Hostages, who made a visitation thrice, and to whom Ireland rendered hostages thrice. The house of Laoghaire, the son of Niall, [erected] long afterwards, was one-third of the extent of the house of Cormac. Three hundred feet in the House of Laoghaire; fifty *imdas*[4] in it; fifty men in each *imda*; fifty *airels* out from

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[1] In an imperfect copy of this document in the same MS.—col. 810—from which the text is here copied,—H. 2. 16, col. 244,—this passage is better given thus: Suiᵹiḋeó Tiġi Miḋċuarṫa ac each riġ laṗ aᵹa i n-ᵹu amail ṗo bui i ṫoṫaiḋ. Teaċ Cuino Ceṫ-ċaṫaiḃ, ocuṗ teaċ Aiṗe Oeṅṁ, mic Cuino Ceṫ-ċaṫaiḃ, ocuṗ teaċ Cormaiᵹ, mic Aiṗe, ocuṗ teaċ Cairḃṗi Liṗeaċair, ocuṗ teaċ each riġ, ṗo bui i Temraiḃ co Niall Noi-ᵹiallaċ. Ar aṫleṫeaḋ eu ṗo ḟiṗi, ocuṗ ṗo ᵹiall h-Eiṗiu oo eu ṗo ḟiṗi.

[2] Teaċ caṫ riġ ṅa boi i Temaiṗ co Niall Noi-ᵹiallaiḋ.—*Book of Glendalough.*

[3] Vallancey has printed this word *his*, having mistaken the contraction for h-Eṗiu, Ireland; but in H. 2. 16, the word is written in full, which puts the true meaning beyond dispute. Vallancey has translated the passage in the following ridiculous manner, which is severely censured by Dr. Campbell, in his Strictures on the History of Ireland: "The palace of Tamar was formerly the seat of Conn of the hundred battles; it was the seat of Art and of Cairbre Liffeachar, and of Cathar Mor, and of every king, who ruled in Tamar, to the time of *Niall of the nine towers*, formed or constructed on three, for he *had vowed to build three towers*."—*Collect.* vol. iii. p. 514.

[4] In H. 2. 16, col. 810, this passage is given differently: Maṫ ṗuiᵹeó ṫiᵹi Temṗaiṫ la Cormaiᵹ, ba mó ṗom amna each. *Ix.* c. eṗaᵹeo iṗ ina raṫ ṗe lino Chormaiᵹ; *viii.* c. eṗaᵹeo a ṫeċ ḟeiṗin. i. e. If [we treat of] the situation of the house of Temur in the time of Cormac, it was larger than all. There were nine hundred feet in the Rath in the time of Cormac, seven hundred feet in his own house.

[5] This word is now used in the north of Ireland to signify a couch, or bed, and in a Gloss on the poem of Kineth O'Hartigan, above given, the word aiṗeṫ is explained by it; but it appears from the ground-plan in the Book of Glendalough, and H. 2. 16, that the *imdas* were the apartments in which the different ranks sat at the banquet.

[6] Better thus in H. 2. 16, col. 810: Ocuṗ ṗicha cubaiṫ a aiṗoai in ṫiᵹi. And thirty cubits the height of the house.

[7] Seċhe ṫreoiṁa immon ṫeċ, ocuṗ oċt n-oṗuiṗ ṗoṗṗ in raiṫ. i. e. Seven *tre-dumas* around the house, and eight doors on the Rath.—*Book of Glendalough.* This passage is given differently in the copy preserved in H. 2. 16, col. 810: *viii.* ṫreoiṁa imonn raiṫ, ocuṗ *viii.* n-oṗuiṗi ṗoṗaiḃ; eṫi l. comaᵹ eimeċaiḷ ṗoṗ in ṗluaᵹ [**] caṫlaċ noṗóa ano; ocuṗ l. leaṫaṗ ṗimṗuime, ocuṗ l. ṗéil n-oṗba ṗoṗṗ

immon raech; ocup vii. n-doirri forraib; ill. comol 'n a cimcholl forr in ṫiġ; l. coṁra clarach n-oṁra; l. leaṫar fiṁruinn fri[n] in riġraiḋ ferṫa; c. n-ool inna dabach; v. cubai a caindelbra; viii. doirrsiriḋa fur; viii. ramairi; ocup viii. n-aiṫemain fur. In charpait foraiġṫeach immo ṫeṫnio fo chuairi. In oṫuiṫe ocup in oṫuich a cum inaid, ocup in chlerṁnaiġ ocup ino airrigiġ naṁa ir in ṫiġ rin. In e-ruaiġ olchena ir ino forcaiġi mon reach, dia necheair, ceir in oa mur, acht in ri do ġairi o Laeġaire do ċum an ṫiġi rin, &c.

them; twenty men in each *airel*. Four cubits [the extent of] the fire-place; and nine cubits [that of] the *foirdles*;[9] and thirty cubits its height upwards (perpendicularly). Seven *tredui* (triple mounds) around the Rath; and seven doors on them; one hundred and fifty *comols* around it [and] the company; fifty grooved golden *corns* (horns); fifty vessels of *finnruine*[9] with the nobles themselves; one hundred drinkings in the vat;[10] five cubits in the candelabra;[11] seven doorkeepers; seven distributors; and seven cupbearers in attendance. The chariot-drivers about the fire around. The druid and the *druith* in the same place, and the mimics and the minstrels only in this house. The people in general were in the *forthaigh*[12] around the house, on the outside, between the two *murs*, but the person that was called into the house by Laoghaire, &c.

Suiġiġaḋ aiġ Ṫemrach la Coṁac,[13] ṁa

The situation of the House of Temur with

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in airrig .i. in dabach; v. cubaio in caindelbrae; viii. n-doirrsire, ocup viii. ramairi; na haṁaio in charpaire forbai imon teni imacuairo; in oṁuiṫ aeu inaro airbiṫe ino riġ; ni conrcairesa nach cuiri o alaile for lar in aiġi sin. Rigoamna ir in aiġ; in e-ruaiġ olchenna imon reach dia neaṫcair. i. e. Eight *tredenna* around the Rath, and eight doors on them; three times fifty [• • • • • •] and fifty vessels of *Findruine*, and fifty golden cups on the *siredig*, i. e. the vat. Five cubits in the *candelabra*; seven door-keepers, and seven distributors; the drivers of the principal chariot about the fire around. The Druid at the *toad mirbithe* of the king; none of them separated from the other in the middle of the house. The nobles were within the house; and the rest of the *host* (i. e. the people in general) around the house outside.

[9] This word is not explained in Irish dictionaries, and it is omitted altogether in Vallancey's printed copy, though he published that copy from this very MS. in H. 2. 16, col. 810, forlerr. The word occurs in the Book of Lismore in such a manner as that its meaning can be inferred. Thus, in describing a palace in the East: "Ni raiḃi roiḃ lep forc reṫ naċ le h-ór oo hiaṫa." There was not a *forlet* throughout which was not closed with gold.

[9] The word *fanruine*, or, as it is most generally written, *fandruine*, is not explained in any dictionary; but it occurs very frequently in Irish romances, and appears to be the name of a whitish metal, perhaps pewter.

[10] The word *Dabhach*, a vat, is explained in Cormac's Glossary as signifying the two-handed vessel.

[11] This word is evidently borrowed from the Latin, and means a chandelier, or large candlestick.

[12] *Forthaigh* is the plural of *forrach*, a seat, bench, &c.

[13] This is given differently in the Book of Glendalough, thus: Mao ṫuiġṫuo aiġi Ṫemraċ la Coṁac, ḃa moo ron; .i. reċe ceċ craiġeo a ceċ rain; noi n-ouiimmon ceċ rain; eṁ coiceaṫ imoaio ir in aiġ, ocup eṁ coiceaṫ reṁ in caċ imoai; ocup eṁ coiceaṫ aiṫel eṫiḃ, ocup coiceaṫ caċ aiṫel. i. e. If [treating of] it, the situation of the House of Temur with Cormac (i. e. as Cormac had it), it was larger [than at any other period]; seven hundred feet in his house; nine circumvallations around that house; three times fifty seats in the house, and three times fifty men in each seat; three times fifty *airels* out from them, and fifty men in each *airel*.

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punn, ba rain ron; *ix.* [cec] eraiged a cech; *xii.* n-oui imo rach immon cech; *lll.* imoinġ ann; *lll.* aiteol erpib; *ix.* fer in gač aiteal; *ix.* cubae a teallač; eri *ix.* cubae a foiroler; *lll.* copn com no ol; *xv.* cubare [* * *] *xvi.* oopur. Mili no o chiaro Cormac eać laei,[14] cen mo eha aer bana ocus pinnola, oi op ocur argae, ocur cairpéiu, ocur eochu, ocur erreda impin.

Suiġiuġad Tiġi Miodhuarta imro, .i. ba imda dec imro hi ceačeap a ba leithi; ocup eriar in gač imdae; ocup *vi.* fir dec hi ceačeap a ba airiseo; ocup ocheup oi rannairib; ocup reačaireib, ocup ballemnaib, in iarpur in tigi; ocup oiar hi ceačeap a ba imda ip in oopur. *C.* fer huile in fin. Da bae, ocup da chinne, ocup da mucc, a prainn punn: coecae for cechetar in da bo, ocup na da mucc, ocup na da chinne; leth do leach ocup leth illeith n-aili. Ōpuiden Miocuarta ainm in tigi sin.

Suiġiuġad Tiġi Miochuarta
Mirbio ouin a raid;

Cormac, [which had existed] before this,[14] was different; nine [hundred] feet in the [extent of the] house; seven circumvallations around the house; one hundred and fifty *indas* in it; one hundred and fifty *airels* out from them; sixty men in each *airel*; nine cubits in the fire-place; three times nine cubits in the *foirdles*, one hundred and fifty drinking cups; fifteen cubits [* * *] twelve doors. Cormac gave presents to one thousand persons each day, besides poets and musicians, in gold and silver, and chariots, and horses, and garments.

The situation of *Teach Midhchuarta* here, viz.: twelve seats in each of its two sides; and three men in each seat; and sixteen men in each of its two *airithers*; and eight distributors; and law-givers, and cupbearers, in the back part[16] of the house; and two in each of the two seats at the door. One hundred men the entire.[17] Two cows, and two *tinnés*, and two pigs, was the quantity for dinner: fifty for each of the two cows and, of the two pigs, and of the two *tinnés*; half to one half and half to the other half. *Bruiden Midhchuarta* [was] the name of this house.

The situation of *Teach Midhchuarta*
Time for us to describe;

[14] That is, which had existed before the House of Laoghaire last described.

[15] This passage is given differently in the Book of Glendalough, thus: Teopa mili ceć lai no erneo Cormac, cen moća aer bana ocus pinoel, ocup cać oen do raigeo in rig. i. e. Three thousand every day King Cormac used to give presents to, besides poets and musicians, and every other person who came to visit the king. The verb erneid is translated *largiri* in Cormac's Glossary, under the word cumlaćeud, and by Colgan in *Trias Thaum.*, p. 515. In the copy in the Book of Glendalough the description of the House of Cormac is given before the House of Laoghaire, which is the correct arrangement of the description.

[16] The *iarthar* of the house means that end of it opposite the door.

[17] $24 \times 3 = 72$, $+ (16 \times 2) = 104$, $+ 8 + 4 = 116$, the true calculation. In the ground-plan of *Teach Miodhchuarta* the house is shewn as divided into five divisions, which are again subdivided into several others. Each of the two divisions extending along the side walls is shewn as subdivided into twelve *indas*, which here means seats; each of the two divisions adjoining them into eight; and the central division is represented as containing three fires at equal distances, a vat, a chandelier, and an *erlaesaich*, besides two compartments on each side of the door, and three in the other extremity of the house opposite the door, occupied by the distributors, cupbearers, and *reachtaires*.

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Cia h-aġa, cia h-aiṛmech[18]	What lawful share, what distinction
Iṛ choiṛ oi cach ġṛaḋ.	Is due to each degree.
Ceṫhṛamṫhu Tiġi Miḋchuaṛṫa	The fourth part of *Teach Miáhchuarta*
Ḋiḋ ṛi ṛiġ aniaṛ ;[19]	Is to the back[20] of the king ;
Teoṛa ceṫhṛamain aili	The other three quarters
Saiṛ co ḋoṛuṛ ḋian.[21]	Eastwards (frontwards) to the door.
Canam, ailem, aiṛneiḋem	Let us sing, extol, relate
Inoa naḋ bi ḋoeṛ,[22]	The place which is not ignoble,
Cia haġa, iaṛ na ḋliġuḋ,	What share, according to law,
Ḋo beiṛ ḋo cach oen.	It gives to each person.
Aṛaiḋ, iṛ moeṛ ṛoeṛ ṛona,	A charioteer, and free affluent steward,
A n-iaṛṫhuṛ in ṫiġi ;	In the back of the house ;
Na cuinn ḋoib, ni ḋliġeḋ ḋona,[24]	The *cuinn*[23] to them, not a bad law,
Aṛ belaib na n-ili ;	Before the many ;
Inḋem cṛuiṫi co ceolaib,[25]	The harpers with music,
Ḋo naṛcnai ṛeġann,	With whom the *segans*[26] are ranked,
Co muc [ṛoṛmuin] in aineṛlam,	Have a hog's shoulder in readiness,
Iṛ cuibṛenn eṛoll.[27]	Which is a distinguished share.
Ollam bṛiṫheman, co m-buaiḋ,	The ollave-brehon, with power,
Aiṛe ṛoiṛġill, ṛíṛ,	The *aire forgaill* 'tis true,
Ḋo beṛaṛ lonchṛoćaiṫ ḋoib,	To them a *lonchrochait* is given,
Ḋunachiṛ ṫic ṛnim.[28]	From which no sadness proceeds.
Sui liṫṫṛi, iṛ ṛi ṛuiṛech,	A *saoi* of literature, and a royal chief,
Iṛṛeim coṛmail choiṛ,[29]	In a just similar rank,
Ḋleġaiṫ aṫhbach, maeṫhġlan min,	Are entitled to the soft, clean, smooth entrails,

[18] Cach aġa, caċ aṛeṛaċ.—*Book of Glendalough.*

[19] Ḋiḋ ṛṛi ṛiġ aniaṛ.—*Book of Glendalough.*

[20] That is, the king sits in the house with his face turned to the principal door, having the one-fourth of the extent of the house behind his back.

[21] Teoṛa ceṫhṛamṫha aile.—*Book of Glendalough.*

[22] Innaṛ naḋ bi ḋaeṛ.—*Book of Glendalough.*

[23] "Cunn, the body, trunk or chest."—*Peter Connell's MS. Dictionary.*

[24] Cunnḋ ḋoib ni ḋliġeḋ ḋona.—*Book of Glendalough.*

[25] Innṛoem cṛuiṫṫ co ceolaib.—*Book of Glendalough.*

[26] Seġuini, huntsmen. This word is explained in the Glossaries of Cormac and O'Clery, as hunter of wild deer. "Seaġuiniḋ .i. ṛeaṛ ġoineaṛ no ṁaṛḃaṛ ṛiaḋaċ.—*O'Clery.*

[27] Co muc ṛoṛmuin in aeneṛlam, iṛ cuibṛenḋ n-eṛoll.—*Book of Glendalough.*

[28] Ollaṁ bṛeiṫheman co m-buaiḋ, Aiṛe ṛoṛġġaill ṛiṛ, Ḋo beṛ lonċṛuaċaiṫ ḋóib, Ḋu naċ ṫic ṛin.—*Book of Glendalough.*

[29] Iṛ ṛeim coṛmail cóiṛ.—*Book of Glendalough.*

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Ir ꝑrim-chroċaiṫ ḋoib.[20]	And to a *prim-chrochait.*[21]
[Do ber] ḋa ollamain ꝑileḋ,[22]	[Is given] to the ollave-poet,
Ir ḋo aire aird,	And to the *aire ard,*
Ꞇarac maiṫh min, miaḋ naḋ ḋorb,	A good smooth *larac,*[23] honor not rude,
Noco labra laiḋc.[24]	It is no false saying.
Ḋriuġu ocur aire ṫuiṡṡi,	The *briugu* and *aire tuissi,*
Con hilup a ꝑaṡach,	With extensive pastures,
Do beraṡ ḋoib, ní raḋ n-iṡṡel,	To them is given, no low saying,
Ꞇarac ḋia ꝑaṡaḋ.[25]	A *larac* to satisfy them.
Do ollomain ꝑencaḋa,	To the ollave-historian,
Cipri airm hi ꝑuiḋ,	Wherever he sits,
Ꞇoarc ḋo ḋia ṫhurġoruḋ,	[Is given] a *larac* to comfort him,
Du hi ꝑannṫaṡ cluiṫh.[26]	Where fame is distributed.
Soer, ir airich echṫa,	An artificer, and *airich echta,*
Cáin a ṫechṫa lib,	Fair their due ye will deem,
Do beṡṫaṡ ḋoib muc ꝑoṡmuin,	To them is given a pig's shoulder,[27]
Ceind maiṡ no ḋliġ.[28]	A long time it has been established.
Ḋrui, ocur aire ḋeṡṡa,	A druid, and *aire dessa,*
Ḋecheng naḋ bi ḋoer,	Two who are not ignoble,
Ḋiblinaib ḋleaġaiṫ ol,	Both are entitled to drink,
Ꞓhlaiṫ colpṫha coem.[29]	They eat a fair *colptha.*[40]

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[20] Ir ꝑrim-ċruaċaiṫ ḋóib.—*Book of Glendalough.*

[21] Cruachaiṫ, or crochaiṫ, means a steak.

[22] Do ber do ꝑilio ollomna.—*Book of Glendalough.*

[23] Ꞇarac is in modern MSS. written larġ. It is thus explained by Peter Connell: "Ꞇarġ, the leg and thigh, or leg or thigh; lon-larġ, the hip and thigh." It is translated *furca* by Colgan in *Trias Thaum.*, p. 173, note 21; and thus in a MS. in Trinity College, H. 1. 13, p. 360, line 15: "Ꞇaarġ .i. ġabul, *ut est* aṫ ḋa laarġ .i. ḋa ġabal."

[24] Ꞇoarġ maiṫ, min, miaḋ naḋ ḋorb, Naḋ ċonḋ labra laḋġ.—*Book of Glendalough.*

[25] Ḋriuġa ocur aire ḋeṡa, Ꞇa ilar * * *. Do ber ḋoib, ní raḋ iṡel, loarġġ ḋia ꝑaṡaḋ.—*Book of Glendalough.*

[26] This line is omitted in the Book of Glendalough.

[27] Muc ꝑoṡmuin, as a compound phrase, is not explained in any Irish Dictionary, but, as ꝑoṡmna is explained the shoulder, shoulder-blade, it seems obviously to mean a pig's shoulder.

[28] Sair ocur aire eċṫa, Canai ṫecṫa lib, Do ber ḋoib muc ꝑoṡmuin, Canaḋmair no ḋliġ.—*Book of Glendalough.*

[29] Ḋiblinaib ebaiṫ ol, Ḋleġaiṫ colpa caem.—*Book of Glendalough.* The meaning is different from that given in the text: "Both refuse to drink, They are entitled to a fair *colptha.*"

[40] Colpṫa, the calf of the leg: "calpaḋa, i. e. *calpoda,* i. e. *bonus pes, vel pedes.*"—*Cormac's Glossary.*

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Copnaipe, ocup cuchchaipe,[41]	The trumpeter, and cook,[42]
Cuipem map copppaip;	Let us place in their order;
Miò mip, ni moò gaechmop,	Cheering mead, not a flatulent kind,
Fri ool no oaipail.[43]	To drink is given them.
Cleipe, ocup paethburġi,	The house-builder, and rath-builder,
Raith rieéip, huap bpuiġ,	The *raith-fitheir*, above the *bruigh*,
Do bnip milġiċan, ppia coil,	To them is given a *milgitan*,[44] by consent,
Si an h-ecal cippi chuin.[45]	'Tis their share every time.
Caipemain, ip copnóipe,	Shoemaker and turner,
Co muincepap choip,	With proper friendship,
Ni bec in mip, monup n-opemun,	Not small the share, fierce work,
Remup n-imoa ooib.[46]	The fat [part of the] shoulder[46] for them.
Dopppaipe, opuich oelma aiṙ,	The door-keeper, the noisy humorous fool,
Cethepn oipcip opuic,	The fierce active kerne,
Oegma a naupṙocha co holl,	Their duty is to call aloud,
Oponn a cuibpenn cuic.[47]	The chine is their share.
Cuipleannaiġ peil, pichéeallaiġ,	Good pipers, chess-players,
In aupṙaiṁin aipthaip,	In the eastern *aurraidin*,[48]
Ip colpcha coip ciaċlep,	A proper *colptha* is given for their skill,

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[41] Copnaipe ocup cuchgaipe.—*Book of Glendalough.*

[42] Cuċeaip, a kitchen: cuchchaipe, a cook.

[43] Fri ol no oa ail.—*Book of Glendalough.*

[44] This word is explained in Cormac's Glossary thus: "Milgeċan .i. mol-ċuiteċan .i. cuic Muil, ooṙiaoa Teṁpaċ: Mol *dicitur* a ammpióe oaṫ an miuil po ṙeṙaiò ooṙṙ na boinib .i. a éaoc ap, eaoc ino: *iade dicitur* Molaċ." It is also explained in a Glossary in H. 3. 18: "Milgeoan .i. mol-cuiteaṅ .i. cuic Moil, ap ip é áiṫe oo beṙéa oo." i. e. *Milgedan*, i. e. *Mol-cuitan*, i. e. the share of *Mol* [the door-keeper of Temar], for it was the lawful share given him.

[45] Celeaipe ocup naeboiġi, Ip paioṙiṁ naċ eban, Do beṙ milgeoan ṙpia coil, ni eccal eip ean.—*Book of Glendalough.*

[46] Caipemain maiṙṙ muṙṙġi, Co muineṙaṙ ċoip, Ni bec, mín, ni mop n-oemon, Remop n-imoa ooib.—*Book of Glendalough.*

[47] Imoa, see p. 149, where this is expressed by ıċheop nemop in e-ṙimnein. Teige O'Rody, in his Gloss on the inauguration Ode of Brian na Murtha O'Rourke, explains imòa by the modern word ṙlinneann, a shoulder. It is also so explained by Michael O'Clery, and thus used in Cormac's Glossary *in voce* oeaċ: "Claiòeṁ ṙon ó eu ino na láiṁe co ṙice in ale ṙil ieṙ in imòa acaṙ in maeéáin." i. e. From the extremity of the hand to the joint between the *imdha* and the *maethan* is called the *claidhemh*.

[48] Olegaiṫ auṙṙocha co ol, Opono oia caema cuic.—*Book of Glendalough.*

[49] The *airidins* are the two divisions of the house on each side of the centre. Each of the *airidins* contained eight *indars*, or seats, in each of which two persons sat at dinner.

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Doib for a meir cuirehir.[50]	Is put for them on their dish.
Scolaigi, ocus oeogbaire,	The *scolaighi*, and the cupbearer,
Debraid eathur brig;	Receive what props their strength;
Leit-chroicce doib ir cuic buan,	A *less-chroichte* is their constant share,
Fo glun ruad ir rig.	Under the knee of the *ruadh* and the king.
Raid ceathra, ocus humaisin,	The *raidh cearda*, and the brazier,
Immurraid each,	As all assert,
Do beir crochaic meadon doib,	A middle *crochail* is given to them,
Ni oenoit in gnad.	Not small the dignity.
Gobainn, legi, luan cen air,	Smiths, physicians,—mention without satire—
Cipece nad bi raeb,	A party who are not foolish,
Nort co brath ar conaire,	A custom to be for ever in existence,
Ar dorreire moel.	To them is given a *moel*.
Mid do thuathaib, ir luamnaib	Mead to the *tuatha*[51], and the mariners
Luaire dar muir nglan,	Who sail over the clear sea,
Milgiedin doib, dignar mod,	A *milgitain* for them, constant the custom,
For meir fo dur cath.	Upon a dish is put.
Saer charpait, ir creaccoire,	The chariot-maker and the *creacoire*,
Cengaid fir firin n-dan,	Abide true to their art,
Dlegaid cam-chnaim fiad gach rig,	Are entitled to a *cam-chnamh* before each king,
Ir dignar in cath.	The custom is constant.
Clerramnaig, reeo fuirreoire,	Jugglers, and buffoons,
Sommech a n-graid n-glor,	Pleasant their noisy calling
Nirt coimeig acu bad ferr,	No better share than theirs,
Do ber colptea doib.[52]	A *colptha* is given to them.
Cuit cainte, ocus braigire,	The share of the satirist, and *braigire*,
Ni lecetar hi fuill,	Is not neglected,
Remuin n-imda doib co gnim,	The fat of the shoulder to them pleasantly,
Ni oimda fri namh.[53]	Not unpleasant to be divided.

[50] Cuirlennaig fert, prochellaig, i n-aimsin airchir, ir colptea coir, cia firt gleir, For a meirt cuirchir.—*Book of Glendalough.*

[51] In H. 2. 16, col. 929, the word *tuathait* is explained as signifying the persons that covered the shields with hides: and in Cuan O'Lochain's poem, given above, page 148, they are called *sciathaire*, i. e. shield-makers.

[52] The preceding six quatrains are omitted in the Book of Glendalough.

[53] Cuit cainte ir braigire, Ni lecchar i fuill, Remuin n-imda, nuall co gnim, Ni oimda fri namh.—*Book of Glendalough.* The *braigire* or *braigitori*, as it is written on the ground-plans to follow, was obviously a Buffoon as well as the *fairseire*; and the different nature of their buffoonery is thus explained in the *Leabhar Buidhe*, col. 936:—"Fuirreoraig .i. do nath an fuirreoraice ar a m-bealaib—Brigeoiri .i. do nath in bruigeoraice ar a conaib." The passage, however, will not bear a translation, but the office of the *braigitori*, as indicated, will be understood from the following line of Dante:

Rannaire, dailemain dein,	The distributor, the swift cupbearer,
Raċtaire réim soer,[54]	The *rachtaire* of free course,
In iarṫar thigi, for lar,	In the back of the house, in the middle,
Ar dosperti moel.[55]	To them is given a *moel.*
Medam nimi, nuall cen áir,	The balancer of heaven, boundless wonder,
Rannus do gaċ aen,	Distributes to each person,
Etir di choem, digrais, fath,	Both to the mild, faithful, wise,
Ocus cach bas chloen.[56]	And to each unjust person.
Cid bec ri caċ uan a chuit,	Though each think his share small,
In arrannaib ric,	In the divisions in which it reaches him,
Mac Muire ar n-dailem, ar coicc,	The son of Mary is our cupbearer, our cook,
H-iss he con dass fic.	It is he who gives.
A mic, mad cobra in fleid,	My son, if the feast was cheerful,
Fomna molaid luid,	Which I have praised in my poem,
Cach iar n-airilliud histig	All after being arranged inside
Fri samugud fri ruith—[57]	In comfort and pleasure—
Teach Midċuarta Riġ Nimi,	The *Teach Midhchuarta* of the King of Heaven,
Ni bai tech ba fuilliu,	There is no house more joyful,
Aċt tol De caċ do dangniu	But except those who do the will of God
Noc a m-bi hi suidiu.	None will be in it.

It remains now to give an explanation of the ground-plans, or tables, illustrating the preceding poem, as given in the two MSS. from which it has been copied; and, first, of the more ancient—that found in the Book of Glendalough. As the matter of these tables has, however, been already to a great extent ex-

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"*Ed egli avea del cul fatto trombetta.*"—Inferno, canto 21, line 139.

It may not perhaps be unworthy of remark, that a manor in England is said to have been formerly held by the tenure of a *saltus*, a *sufflatus*, and a *crepitus ventris*, enacted in the presence of the king.

[54] This word would signify either a lawgiver, or a herdsman, in which latter sense it is thus explained in O'Clery's glossary: "Reaċtaire .i. aoḋaire aoḋaire airneige." *i.e.* a herder of cattle. It is obviously used in this sense here.

[55] Rannaire cein dalemain, Reċtaire reim saer, In iarṫur tige for lár, Arrosperte mael. —*Book of Glendalough.*

[56] Meda mine nual caen air, Rannais do caċ oen, Etir di chaem digrais fáth, Ocus fáth bas chaem.—*Book of Glendalough.*

[57] Cid bec la cach uan a ċuit, Im a rannaiḃ ric, Mac De ar n-dailem, ar coic, is e con dic. A meicc maḋ cobra in fleid, Fonma molaid luid, Iar na rullud caich istig, Fri sanrigud suid.—*Book of Glendalough.* There is evidently some defect in the text of these concluding verses, as appears from a comparison of the two copies. The reading in the Book of Glendalough is the more correct, but it is to be regretted that the last quatrain of this poem is entirely effaced in that manuscript.

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Huabo mc ryḋcon mc allmoe mc cuaṫad
mc caṫe cacorchino cṫna ṡḟ lar nḋṁad
ṡṫh mor mocṁaṁoa ᵹ ṡ in hḟi.

Tech mocṫgda.

Dabach

Daben
am myl
boib

Caṫap

bup bzuṫiṫ

Daul

Ceṫ

Ceṫoc

Rectge
mel boib

Focellaiz
colpcha .b.

Deoxbḃe
lḟ cḟnua
chaic boib

Umaroo
ṁchṁa
chaic .b.

Cḟb mel
boib

Cuamarn
miliḋan
.b.

Cpeccarn
cam cṁaṁ
.b.

Dzaṡḋeo
ṗ ṗḋmuṁ
nmoa .b.

Dpuch ṗiḋ
bpoṁa .b.

Doṁarn
ṗiḋ baṫa
na boib

Ramaṁ
y clocarn
ṗḋmuṁ mi
ba .b.

Apaio cuiṡ
boib.

Sḟuṫni mc
pozmuſ boib

Aṁṁ ḟḟaill
ion cṁaċaiṫe
.b.

Aṁṁ lon
cṁaċaiṫe .b.

Aṁe ḋo lo
aṁṡ bó.

Aṁi bḟa
loaṁ bó.

Ch. cáchmal
bó.

Sḃicaio cá
cḣnaṁ .bó.

Aṁe echea
mc ṁuſ bó

Caṁo cá cnaſ .b.

Aṁi bḟa y
boſſ colpcha
boib.

Ḟḟc ṫuṁnio
y pochloc ṫi
cḣnaċaiṫe .b.

Cuchchaiṁ y
mbuṁp ṗ-
muṁ nmoa .b.

Rachbuṁge y
obzaṁe mil
ᵹeṫaṁ boib

Rathe
mel boib.

Curiḋn
baiṫ col
ṁa boib

Scolai
ᵹe-liſ
cḣnua
chaiṫ .b.

Kobaiṁ
mael .b.

Cnaṫaiṫ
miliḋe
caṁ .b.

Cappae

Ṡaeṁ cá
cḣnáiṫ .b.

Cliaṫáin
aiṫ colp
cha .b.

Cṫṁiḋ
y buṁ
ṗ-muiṫi
nuṁ roṁb
.b.

Ramiḋ
y naṫcai
ṗ-miliḋe
caṁ boib

Caṁe
maṁ y
roṁ ḋi
ṗḋmuṁ
nmoa
boib.

Rathe
mel boib.

Curiḋn
baiṫ col
ṁa boib

Scolai
ᵹe-liſ
cḣnua
chaiṫ .b.

Kobaiṁ
mael .b.

Cnaṫaiṫ
miliḋe
caṁ .b.

Cappae

Ṡaeṁ cá
cḣnáiṫ .b.

Cliaṫáin
aiṫ colp
cha .b.

Cṫṁiḋ
y buṁ
ṗ-muiṫi
nuṁ roṁb
.b.

Ramiḋ
y naṫcai
ṗ-miliḋe
caṁ boib

Caṁe
maṁ y
roṁ ḋi
ṗḋmuṁ
nmoa
boib.

Haṁcaiṫ
cuiṁb boib

Cṁaṫeṡṁ
mc ḟ-muiṁ
boib.

Dṁchṁaṫ
lonċṁiaṫ
boib

Sinb lreṁ
lon cḣnua
ċaiṫ boib.

Canaṁe ṡuab
lḟċṁaċaiṫe
.b.

Ollam ṗilḋ
loaṁṡ boib

Aṁoch ṗil
caṁ ċnáiṫ .b.

Ò ṫṁṡa cṫoċ
loaṁṡ bó.

Aiṫcaṫḋ
porchnech bó

Ḟaṁ y ṁuṁ
y cómlḃ
colpcha boib

Cleaṁe y ḟḋ
cṁaċaiṫe .b.

plained in the translation of the poem, it will only be necessary here to resolve the contractions in the text, and translate it in the order of the plan—first reading the two external columns, and then the two internal in like manner, as it appears from the poem that the several ranks of the household were arranged in this order. It should, however, be remarked that the texts of both these tables—which are evidently copied from different originals—not only disagree from each other in several instances, but also from the text of the poem itself; and, though these differences may have arisen in part from the carelessness of the transcribers, it is obvious that in some instances they originated in attempts to shape the words of the original documents according to their own ideas of their meanings, and particularly in the transcript in the Book of Glendalough, which is much less accurate than that in the *Leabhar Buidhe.*

The following are the names in the external division to the left:

1. Marcaig:—cuind doib.	Horsemen:—*cuind*[1] for them.
2. Cruiteiri:—muc-formuin doib.	Harpers:—a pig's shoulder for them.
3. Brithemain:—lon-ċruaċaiṫ doib.	Brehons:—a *lon-chruachait*[2] for them.
4. Suid liṫṫri:—lon-ċhruaċaiṫ doib.	Professors of literature:—a *lon-chruachait* for them.
5. Tanaire fuad:—les-ċruaċaiṫ doib.	Tanist-professors:—a *les-chruachait*[3] for them.
6. Ollam filed:—loarg doib.	Ollave-poets:—a *loarg* for them.
7. Anroth filed:—cam-ċnaim doib.	*Anroth*-poets:—a crooked bone for them.
8. Briuga cetoċ:—loarg dó.	*Briuga cetoch*:[4]—a *loarg* for him.
9. Augtarsairsi:—roichnech dó.	*Augtarsairsi*:—a *roichnech* for him.
10. Fáidi, ocur druid, ocur commilid:—colptha doib.	Augurs, and druids, and *commilid*:—a *colptha* for them.
11. Aleṫaire, ocur fair:—cruachaiṫ doib.	House-builders, and carpenters:—a *cruachait* for them.

In the external division to the right:

12. Araid:—cuind dóib.	Charioteers:—*cuind* for them.

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[1] Cuind, or cuinn, is the plural of cunn, which is explained copp, the body, in all the Glossaries.

[2] Cruachaiṫ. See note 3, page 208.

[3] Les-ċhruachaiṫ, steak of the thigh.

[4] The *Brughaidh Cetoch*, or *Ceadach*, i.e. the centurion *Brughaidh*, or, Brughaidh of the hundreds, was so called, according to the *Leabhar Buidhe*, col. 921, because he was bound by the law to have one hundred slaves, or labourers, and one hundred of each kind of cattle and other animals, as cows, horses, pigs, sheep, goats, hounds, cats, hens, geese, bees, &c.

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13. Seguinni :—muc formuin doib.	Huntsmen :—a pig's shoulder for them.
14. Airig forgaill :—lon-ċruachaiṫ doib.	*Airig forgaill* :—a *lon-chruachait* for them.
15. Muirig :—lon-ċruaċaiṫ doib.	*Muirig* :[5]—a *lon-chruachait* for them.
16. Aire aird :—loarg dó.	*Aire aird* :—a *loarg* for him.
17. Airi dera :—loarg dó.	*Aire desa* :—a *loarg* for him.
18. Clí :—cam-chnaim do.	*Cli* :—a crooked bone for him.
19. Senċaid :—cam-chnaim dó.	Historian :—a crooked bone for him.
20. Aire echta :—muc-formuin dó.	*Aire-echta* :—a pig's shoulder for him.
21. Cano :—cam-ċnaim do.	*Cano* :—a crooked bone for him.
22. Airi dera, ocur dorr :—colpṫa doib.	*Aire desa*, and *doss* :—a *colptha* for them.
23. Macc furmid, ocur fochloc :—ir-chruachaiṫ doib.	*Macc furmid*, and *fochloc* :—an *ir-chruachait* for them.
24. Cuṫchairi, ocur midimir :—remur n-imda doib.	Cooks, and *midimir* :[6]—the fat [part of the] shoulder for them.
25. Rathbuirge, ocur obraige :—milgetan doib.	Rath-builder, and *obraige* :—a *milgetan* for them.
26. Mairig, ocur cladairi :—remur n-imda doib.	*Mairig* and *cladairi* :—the fat [part of the] shoulder for them.

In the internal division to the left :

27. Rannaire :—Mael doib.	Distributors :—a *mael* for them.
28. Curlennaig :—colpda doib.	Pipers :—a *colpda* for them.
29. Scolaige :—lef-chruachaiṫ doib.	*Scolaige* :—a *les-chruachait* for them.
30. Gobainn :—mael doib.	Smiths :—a *mael* for them.
31. Tuaċaiṫ :—milgetain doib.	Shield-makers :—a *milgetan* for them.
32. Carrae raer :—cam-chnaim doib.	Chariot-makers :—a crooked bone for them.
33. Cleṫṫamnaig :—Colpṫa doib.	Jugglers :—a *colptha* for them.
34. Cornairi, ocur bunnirri :—midi mir tond doib.	Trumpeters, and footmen :—cheering mead abundantly for them.
35. Rannairi,[7] ocur iarcairi :—milgetan doib.	Distributors, and fishermen :—a *milgetan* for them.
36. Cairemain, ocur torcairi :[8]—remur n-imda doib.	Shoemakers, and *toscairi* :—the fat [part of the] shoulder for them.

[5] This word is written *Ruirig* in the table in the *Leabhar Buidhe*, and, as it would appear, more correctly.

[6] *Midimir* is a mistake of the transcriber, as will appear from the other table, and from the poem.

[7] These names are obviously incorrectly copied, as *Rannaire* is given before. In the table in the *Leabhar Buidhe* they are more correctly written Rinnaire ocur Narcaire, which would signify engravers and *nasc*, or ring, makers—the word *nasc* meaning a collar, bracelet, or ear-ring—any ring that opened.

[8] These words are written cairemain ocur tornoire, or shoemakers and turners, in the table in the *Leabhar Buidhe*.

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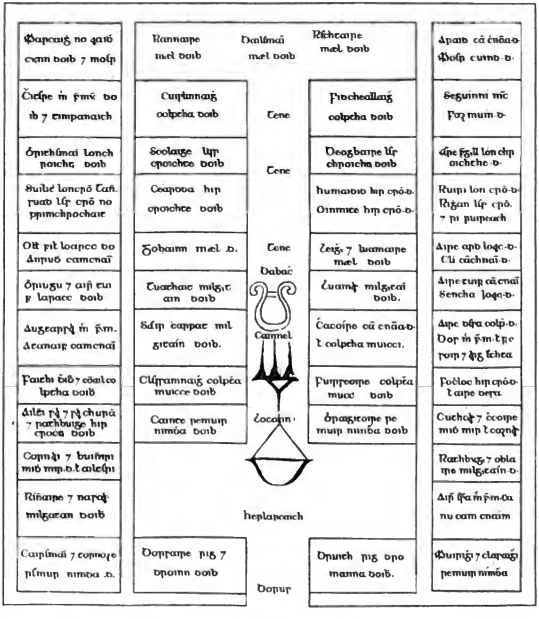

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In the internal division to the right.

37. Rećtaire :—mael doib.	Herdsmen:—a *mael* for them.
38. Fiocellaig :—colpcha doib.	Chess-players :—a *colptha* for them.
39. Deogbaire :—lep-chruachaic doib.	Drink-bearers :—a *les-chruachait* for them.
40. Umaidid :—ir-chruachaic doib.	Braziers :—an *ir-chruachait* for them.
41. Lead :[9]—mael doib.	Physicians :—a *mael* for them.
42. Luamairi :—milgetan doib.	Mariners :—a *milgetan* for them.
43. Creccairi :—cam-ćnaim doib.	*Creccairi* :—a crooked bone for them.
44. Braigetori :—remur n-imda doib.	*Braigetori* :—the fat [part of the] shoulder for them.
45 Druch rig :—dromanna doib.	King's fools :—backs for them.
46. Dorrairi rig :—dronna doib.	King's door-keepers :—chines for them.

The following are the names in the central division of the house :—

47. Dabach.	Vat.
48. Dalemain :—mael doib.	Cup-bearers :—a *mael* for them.
49. Larrar.	Flame [of the lamp.]
50. Sir bruinner.	Spit.
51. Daul.	Waiter.
52. Lef.	Thigh [the piece of meat which the *daul* is roasting.]
53. Lóćet.	Flame [of the fire.]

An entry written over this ground-plan in the Book of Glendalough, preserves the name and pedigree of the builder of *Teach Miodhchuarta*. It runs thus :—" Nuado mac Faelćon mic Alldoit mic Thuataid mic Caitt catotchind cetna fer lar n-derrad tech mór midćuardda ar túr in h-Erinn." i. e. Nuado, the son of Faelchu, son of Alldoit, son of Tuathaid, son of Caitt Catotchenn, was the first man by whom the great house of *Midhchuardda* was first erected in Ireland.

The references in the second ground-plan are as follows :—

In the external division to the left.

1. Marcaig, no araid, ocur moer :—cuinn doib.	Horsemen, or charioteers, and stewards :—*cuinn* for them.
2. Cruitere, ocur timpanaich :—muc-formuin doib.	Harpers, and tympanists :—a pig's shoulder for them.

[9] In the *Leabhar Buidhe* this word is more correctly written Leig, physicians.

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3. Brithemain :—lon-chroichti doib.[1]	Brehons :—a *lon-chroichti*[2] for them.
4. Suí litri :—lon-croichti.	Professor of literature :—a *lon-chroichti*.
Tanaise[3] suad :—les-crochait, no prim chrochait.	Tanist professor :—a *les-chrochait*, or *prim-chrochait*.
5. Ollam filed :—loarcc do.	Ollave-poet :[4]—a *loarcc* for him.
Anrud :—cam-cnaim.	*Anrudh*:[5]—a crooked bone.
6. Briugu,[6] ocus aire tuisi :[7]—Laracc doib.	*Briugu*, and *aire tuisi*:—a *laracc* for them.
7. Augtarsair :—muc-formuin.	*Augtarsair* :—a pig's shoulder.
A tanaisi :—cam-cnaim.	His tanist :—a crooked bone.
8. Faithi, druide, ocus comail :—colptha doib.	Augurs, druids, and *comail* :—a *colptha* for them.
9. Ailteri, saír, ocus sair-churan, ocus rathburge :—h-ir-croćti doib.[8]	House-builder, carpenter, and *saer-churan*, and rath-builder :—an *ir-crochti* for them.

[1] It is stated in the *Leabhar Buidhe*, p. 921,—that a Brehon, who knew the three *berlas* or dialects, i. e. of the *fenechas*, of poetry, and of the *leighenn*, or general literature, had the same rank and stipend with the *airech tuisi*.

[2] Lon is explained by O'Neachtain, the hip, and lon-lairge, the shin and thigh; but croćait is not explained in any Irish dictionary. It appears, however, from the context of many passages in which the word occurs, that it means a *steak*. Lon-ćroćait then means the hip steak; les-ćroćait, the thigh steak; ir-ćroćat, the rump steak; prim-ćroćhait, the prime steak.

[3] Vallancey deciphers *suí litri* and *tanaise suad* thus—*suilitri* and *taman*, and translates them "Heralds and Tamans," which latter word he afterwards explains in a note as signifying magicians. But *sui litri* is used throughout the Irish Annals to signify "a man of letters, a teacher of general literature," and *tanaise suad*, erroneously read *taman* by Vallancey, who obviously mistook tan, the contraction for tanaise, for *taman*, means that person who was intended to succeed the *sui litri* in his profession. It is stated in the *Leabhar Buidhe*, that the *sui litri*, otherwise called *fear leighinn*, or professor, or, as Colgan translates it, *scholasticus*, had the same dignity with the chief of a *triocha ced* or barony. His tanist or intended successor had the same dignity with the *airech ard*; the *oc-sai*, otherwise called *forcedlaidh*, i. e. teacher, had the same dignity with the *airech forgill* of the lowest rank, and the *staraidh*, or historiographer, who was the fourth in rank under the *sui litri*, had the same rank with the *airech dessa*.

[4] Vallancey explains this professor of the *file*, but the *ollamh-file* means the head poet, or chief poet.

[5] Vallancey leaves this untranslated and unexplained, but its meaning is put beyond dispute in Cormac's Glossary: "Anruṫ, i. e. *nomen secondi gradûs poetarum*."

[6] Briuġu generally written brúġaiḋ, means a public victualler, a farmer.

[7] Aire or aireć is explained in the Glossaries of Cormac and O'Clery, as a general name for every degree of the nobility in a country: Ainm coitcend cach gráḋa flatha i tuaiṫ.—*Cor. Gloss.* It appears from the Brehon laws that there were seven degrees of *airechs* in Ireland, and named, 1, *airi dessa*; 2, *airi echtai*; 3, *airi ard*; 4, *airi tuisi*; 5, *aire forggaill*; 6, *Tanaisi righ*; 7, *righ*. See H. 3. 18, p. 3. col. 1. In the account of these seven degrees, preserved in the Book of Ballymote, fol. 182, the next in rank to the king is called *ri-ruireach*, which was another name for the tanist.

[8] In the *Leabhar Buidhe Lecain*, col. 921, *et sequen.*, a curious classification of these tradesmen is given. The most distinguished of them is called *ollamh suadh sairsi*, i. e. ollave or head tradesman, who was the builder of the *daimliags* and *duirtheachs*, that is of stone churches and penitentiaries. He is described as equal in dignity with the *airech ard*. The builder of *duirtheachs* only is ranked with the *airech dessa*. The next in point of rank after these are the chariot-makers, the house-builders, the smiths, the engravers, and *tuathaits* or shield-makers, all of whom are ranked with the

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10. Cornaire, ocur buinneis,[9] no aitreabh :—mid mir doib. — Trumpeters, and footmen, or house-builders :—cheering mead for them.
11. Rinnaire,[10] ocur suirgaire :—milgarum doib. — Engravers, and ring-makers :—a *milgatan* for them.
12. Cuirmeann, ocur cornore :[11]—remur n-imda doib. — Shoemakers, and turners :—the fat [part of the] shoulder for them.

In the external division to the right.

13. Arad :—cam-charma doib. Moer :—cuind do. — Charioteers :—crooked bones for them. Steward :—*cuind* for him.
14. Seguinni :—muc-rophuin doib. — Hunters :—a pig's shoulder for them.
15. Aire forgill :—lón-chroichee doib. — *Aire forgill :*—a *lon-chroichte* for them.
16. Ruiri :—lón-croichee doib. Rigan, ocur ri ruireach :—lep-croichee. — *Ruiri :*[12]—a *lon-chroichte* for them. Queen, and royal *ruireach :*—a *les-croichte* [for them.]
17. Aire ard :—loarc doib. Cli :[13]—cam-chnaim doib. — *Aire ard :*—a *loarc* for them. *Cli :*[13]—a crooked bone for them.
18. Aire tuisi : cam-cnaim. Sencha :—loarc do. — *Aire tuisi :*—a crooked bone. Historian :—a *loarc* for him.
19. Aire desa :—colptha doib. Dos :[14]—muc-rophuin. *Vel sic :* Sosp, ocur airig echta. — *Aire desa :*—a *colptha* for them. *Dos :*[14]—a pig's shoulder. Or thus : Carpenters, and *airig echta.*
20. Fochloc :—li-ip-croicee do. No : aire desa. — *Fochloc :*[15]—an *ir-croichte* for him. Or : *aire desa.*

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tanist *Bo-airech.* The next after these are the turners, ring-makers, embroiderers or shoe-makers, *cirmaires,* and fishermen, all of whom are classed with a *feor midhath* of the lowest rank, if they be lawful, that is, if they have learned their arts according to law; but, if they be unlawful, they have no rank, and receive no salary. The salary of each was *four screbals.*

[9] Vallancey translates this "the sacrificing priest and his attendants;" but cornaire, which is derived from corn, a horn, means either a cup-bearer, or a trumpeter, and buinnire is always used to signify a footman, or messenger. It is thus explained by O'Clery, who was a perfect master of the ancient Irish language: "Buinnire .i. giolla eurair, eaclaid no coiteas," i. e. *Buinnire,* a messenger, envoy, or footman.

[10] Translated "astronomers and genealogists, or diviners," by Vallancey; but rinnaire is of constant occurrence in Irish MSS. in the sense of carver, or engraver, and in no other.

[11] Vallancey has joined the word remur with cornore, and so translated it, turners in *coarse wood;* but the adjective remur, fat, is joined with imda throughout, as can be proved from the poem.

[12] This word is thus explained in O'Clery's Glossary: "Ruiri—rig no tigearna," i. e. a king, or lord. It is also used to denote a champion.

[13] *Cli,* a poet of the third order.—See *Cormac's Glossary.*

[14] *Dos,* a poet of the fourth order.—See *Cormac's Glossary.*

[15] *Fochloc,* a poet of the lowest rank.—See *Cormac's Glossary.*

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21. Cuthcaire, ocur creccoire, no cornaire :—mió mir.	Cooks, and *creccoire*, or *cornaire* :—*midh mir.*
22. Rathbuirgi, ocur oblaire :—milgitain doib.	Rath-builder, and *oblaire* :[16]—a *milgitan* for them.
23. Aire echta :—muc-rormuin.	*Aire echta* :—a pig's shoulder.
Canu :—cam-cnaim.	*Canu* :—a crooked bone.
24. Muirigi, ocur clasaigi :—remuir n-imóa.	*Muirighi*, and *clasaighi* :[17]—the fat [part of the] shoulder.

In the internal division to the left.

25. Cuirlinnaig :—colptha doib.	Pipers :—a *colptha* for them.
26. Scolaige :—lesr-croichte doib.	*Scolaige* :—a *les-chroichte* for them.
27. Ceapra :—h-ir-croichte doib.	Artisans:[18]—an *ir-chroichte* for them.
28. Gobann :—mael doib.	Smiths :—a *mael* for them.
29. Cuathaire :—milgitain doib.	Shield-makers :—a *milgitan* for them.
30. Saeir carpat :—milgitain doib.	Chariot-makers :—a *milgitan* for them.
31. Clerramnaig :—colpéa muicce doib.	Jugglers :—a pig's *colptha* for them.
32. Cainte :—remuir n-imóa doib.	Satirists :—the fat [part of the] shoulder for them.

In the internal division to the right.

33. Fiocheallaig :—colptha doib.	Chess-players :—a *colptha* for them.
34. Deogbaire :—lesr-chroichti doib.	Drink-bearers :—a *les-chroichti* for them.
35. h-umaiuib :—h-ir-croichti doib.	Braziers :—an *ir-chroichti* for them.
Oinmite :—h-ir-croichti doib.	Fools :—an *ir-chroichti* for them.
36. Leigi, ocur luamaire :—mael doib.	Physicians, and mariners :—a *mael* for them.
37. Luamaire :—milgitain doib.	Mariners :—a *milgitain* for them.
38. Creacoire :—cam-cnama doib, no colptha muicci.	*Creacoire* :—crooked bones for them, or pig's *colptha.*
39. Fuirreoire :—colpéa muc doib.	Buffoons :—a pig's *colptha* for them.
40. Braigitoire :—remuir n-imóa doib.	*Braigitoire* :—the fat [part of the] shoulder for them.

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[16] No authority has been found to explain this word. It is written obraige in the table in the Book of Glendalough, and would appear to be formed from the word obair, a work, labour, and to signify an artisan, or artisans—perhaps house-builders.

[17] These words in their compound or derivative forms are not found in any dictionaries; but there can be little, if any, doubt that they are formed from mur, a wall, and clar, a trench, and signify wall-builders and trench-makers. The word *muirighi*, would indeed signify a mariner; but, as this class is elsewhere expressed in the table, under the word *luamaire*, it could not be used in that sense here.

[18] In the *Leabhar Buidhe Lecain* it is stated that the *kerds* worked in gold and silver only. In Ulster and Lower Connaught this word is now only applied to a tinker, and it is probable that the modern tinker is, in a modified and debased degree a representative of the ancient *kerd.*

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In the *Iarthar*, or back of the house.

41. Rannaire :—mael oib.	Distributors (or dividers) :—a *mael* for them.
42. Dailemain :—mael oib.	Cupbearers :—a *mael* for them.
43. Recheaire :—mael oib.	Herdsmen :—a *mael* for them.

At the left side of the door.

44. Doprraire ris :—ocus sroinn oib.	The king's doorkeepers :—and chines for them.

At the right side of the door.

45 Druith ris :[10]—sromanna oib.	The king's fools :—backs for them.

In the central division of the house.

Tene.	Fire.[10]
Dabaċ.	Vat.
Cannel.	Candle.
Cocarn.	Lamp.
h-eplarcaich.[11]	Common Hall.
Dorus.	Door.

It will be seen from the occasional disagreement in the arrangement of the preceding tables, that they are not copied from the same original; and the inference is unavoidable, that both are only attempts of the old scribes to shew the arrangements of the Dining-hall, at Tara, as derived from bardic traditions, and their knowledge of the customs still prevalent among the Irish kings and great lords in their own times. That these ancient customs were indeed preserved to the times of the writers of the poems, has been already shewn from the statement of the poet Cuan O'Lochain; and it can scarcely be doubted that they were perpetuated, though on a limited scale, in the household of every chief, not only in Ireland, but also in the Highlands of Scotland, as late even as the sixteenth century. Of this fact a curious evidence is given by Martin, in his Description of the Western Islands of Scotland, p. 109. After stating that "their antient leagues of friendship were ratify'd by drinking a drop of each other's blood, which was commonly drawn out of the little finger," and that "this was religiously

[10] "Druć .i. Oinmic, *quasi* Dirać .i. cin riaċ rain ina cinerib."—*Cormac's Glossary.*

[10] Three fire-places are marked in the second ground-plan.

[11] This word is not found in any dictionary, or MS. glossary; but it appears obviously to be a compound of the words Eplar, or Uplar, a floor, or hall, and cuic, the genitive of cac, the whole, the people or commonalty.

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observ'd as a sacred bond"—a custom, the antiquity of which in Ireland has been shewn at p. 121 in this memoir—he adds, that "before mony became current, the chieftains in the Isles bestow'd the cow's head, feet, and all the entrails upon their dependents; such as the physician, orator, poet, bard, musicians, *&c.* and the same was divided thus: the smith had the head, the piper had the, *&c.*" And it may not be unworthy of remark, that a remnant of these ancient usages is preserved in many parts of Ireland to this day, namely, that when a farmer kills a beef or pig, it is customary to send the head to the smith, whose kitchen often presents the spectacle of from fifty to one hundred heads obtained in this manner.

There is one feature in the first or more ancient of these tables, which requires some more particular illustration than a mere explanation of its name—the *Bir bruinneas*, or spit on which the *daul*, or waiter, is roasting a *les*, or round of beef! That the ancient Irish used instruments of this description for cooking is satisfactorily proved from innumerable evidences found in the most ancient MSS., and the spits used in the *Teach Miodhchuarta* at Tara have been deemed worthy of a particular description, and even the names of their supposed fabricators, or perhaps inventors, have been preserved by the bards. How far, indeed, these descriptions may be worthy of historic credit must be left to the judgment of the reader; but they are, under any circumstances, worthy of preservation, as evidences of the notions of mechanics existing in Ireland at the time of the writers, and they may with great propriety be adduced here in connexion with so many other illustrations of this locality.

The spit, represented in the plan or table alluded to, is called *Bir-bruinneas*—but though the word *bir*, which appears cognate with the Latin *veru*, undoubtedly means a spit, the meaning of the epithet *bruinneas* is by no means clear, as no explanation of it has hitherto been found. It is possible, however, that it may mean roasting, as the word seems to have some affinity to the German *brennen*, to burn; or it may be formed from the word bpuinn, a caldron, as explained by O'Clery, and mean boiling, roasting, or cooking generally, as the ancient Irish do not appear to have had distinct words to express roasting and boiling. It appears from notices found in other MSS. that the spit at Tara was known by another name, partly derived from that of its inventor, namely, *Bir Nechin*, or *Dechin*, the spit of Dechin, who, according to these authorities, was the chief smith of

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Tara in the time of the Tuatha-De-Dananns; as in the following passage from the *Leabhar Buidhe*, H. 2. 16, col. 245.

Inoeóin gnaehach in Dagda do gnerr in ro.

The usual *inneoin* of the *Daghda* here.

Dir Nechim in ro .i. Neichen primm-goba na Temrad. Ir e ceetna goba do ro ching hi Tech Miochuarta, conid ro fuirmead in airm ar na roicheo ceimid, co n-deirgine bir co lúd co mad roichead ceimid, ocus co cimraigeo in a durunn eun aili.

Bir Nechin here: Nechin was the chief smith of Temur. He was the first smith who went into *Teach Midchuarta*, so that he sunk the spot where a fire should rise, and he made a spit with motion that it might reach the fire, and that it might coil into its *durunn* another time.

This spit, as well as one of another description, called *Inneoin an Daghdha*, or the spit of the Daghdha, is thus noticed in another ancient MS. in the same library, H. 3. 18, p. 433.

Inneoin in Dagda. Noco nuil cinneo fuigidi fuirri, acht ro laigeo re grigraig ocus ro eirgeo re lasrain; ocus do bid a leabh ar muin gach fir ar na marach.

Inneoin of the *Daghdha*. There is no fixed situation for it, but it used to lie with the cinders and rise with the flame; and its *leadhb* used to be on the back of each man on the next day.

Goibneno ir é do rinne in dir Deicen. Drinne, mac Cuchair, ir e do rinne Inneoi in Dagda; ocus ir amlaid ro bi, ocus maide gacha cinn di, ocus crann a mol,* ocus crann a roe, ocus iarann a corp; ocus do bacair da naí poch in a mol, go mad luathaide ag imroo, ocus trichi bir do bid arr, ocus trichi drol, ocus trichi ferrad, ocus com luaide re luar frotha ag imroe: ocus tri na m-berna, ocus tri na cuill, ocus daen bir re fuineo, ocus daen gaide do cuirred ar luch hi.

It was Goivnenn that made the *Bir Deichen*. It was Drinne, the son of Luchair, who made the *Inneoin* of the *Daghdha*; and it was thus: a stick at each end of it, and its axle was wood, and its wheel was wood, and its body was iron; and there were twice nine wheels on its axle, that it might turn the faster, and there were thirty spits out of it, and thirty hooks, and thirty spindles, and it was as rapid as the rapidity of a stream in turning: and thrice nine spits, and thrice nine cavities (or pots,) and one spit for roasting, and one wing used to set it in motion.

These cooking instruments, together with a third called *Fulacht na Morrighna*, or the spit, or cooker, of the great queen, are also noticed in a fragment of the Brehon Laws in the same MS., and on the same page.

. . . . . .

Ir ri sruime dana dlegair do'n gobainn

This is the *druine dana* which is due to the

* The word mol is now used in Ireland generally to express the axle or shaft of a mill, and it is used in the same sense in Cormac's Glossary.

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in ean aca eneclano comlan oo, .i. bir Deichen, ocur Mulaċe [*recte* Fulaċe] na Mor-riġna, ocur Inneoin in Daġda. bir Deichin, .i. bir ro ba aġ Deichin, goba ro baí i Temraiġ; ocur ro roicheo o rraiġió go reirno, i Tiġ Miċuarca, ocur ro reiġeea airiġei Tiġi Miċuarca air, ocur ro cuilleo 'n a rbopan ar na marach.

Fulache namor-riġna. Tri biaóa air rioe, .i. biaó bruiche, ocur biaó om, ocur im; ocur ni ba luirg in biaó bruiéi, ocur ba bruiéi in biaó om, ocur ní ba leġéa in e-im, aċe amail buó éoir.

smith when his full remuneration is given him, viz. *Bir Deichen*, and *Fulacht na Mor-righna*, and the *Inneoin* of the *Daghdha*. *Bir Deichen*, i. e. a spit which belonged to Deichen, a smith who was at Temur; and it reached from the roof to the fire, in *Teach Midchuarta*, and the *airighthe** of *Teach Midchuarta* used to be warmed on it, and it used to return into its purse on the next day.

Fulacht na Mor-righna. Three kinds of victuals on it, i.e. dressed victuals, and raw victuals, and butter; and the dressed food was not burned, and the raw food was dressed, and the butter was not dissolved, but as was proper.

The *Fulacht na Mor-righna* is also noticed in the MS., H. 2. 16, col. 245, as follows:

Fuluche na mor-riġna in ro, .i. bloġ oi reoil h-uim ocur ar aili oi reoil ronaiche, ocur mir n-immi ippe; ocur ni legaio an im, ocur ba ronaiche an om, ocur ni ba loiscthi an bruiche, ocur moale no bieir a eniur por in m-bir.

Do oechaeur era .ix. cuici reom, oo cumgió Inoeóine oo oenam ooib, arboir oi-berguiб, .i. Inneoin ocur .ix. n-airle inei, ocur oo beneo each oib a airil 'n a laim can teigoir caiocht, ocur conoricir caċ oib por a corra fri ar aili oiú láe; ocur no chocabeha co m-ba com aro fri per in ean ba aolaice, ocur ni ba airoiú or reinio oloar oorn ean aili por na coraib ceena, cen leapaó, cen cimoibi: oeiċbep ron ar ba xarn a oomna.

Fulacht na Mor-righna here, i.e. a piece of raw meat and another of dressed meat, and a bit of butter on it; and the butter did not melt, the raw was dressed, and the dressed was not burned, even though the three were together on the spit.

There went to her [i. e. Mor-righain] on one occasion nine persons, to request that an *Inneoin* would be made for them, for they were outlaws, i.e. an *Inneoin* with nine ribs in it, and each of them carried his own rib in his hand wherever he went, until night, and they joined them all together on its posts when they met at the close of the day; and it used to be raised to the height of a man when it was desirable, and it was not higher over the fire at another time than a fist on the same posts, without breaking without diminishing: the reason was because its material was iron.

To proceed now with the remaining features: the monuments next described in the prose, as in the immediate vicinity of the *Teach Miodhchuarta*,

* *Airighthe*, i. e. the respective shares or portions allotted to the different ranks.

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are *Mur na d-tri g-Cogur*, or the *Mur*, or Wall, of the Three Conspiracies, and *Lia na b-Fian*, or the Stone of the Heroes, or Soldiers. Of the first, it is only stated in the prose that it was situated in the vicinity of *Teach Miodhchuarta;* but the verse most distinctly marks that it was between the *Long* and the Heroes' Well. To this Well there is no other allusion in any of the documents, but this is sufficient to point out the locality of the *Mur*, as the Well is still to be found to the north-west of the Hall, though it is now generally dry. Of the monument itself there are no remains, and no illustration of its history has been found. With respect to the second feature, the Stone of the Heroes, the prose and verse both state that it was situated to the east of the road, opposite the Rath of the Synods—a locality now occupied by the village—and consequently no vestige of the monument remains; nor has anything been found that would serve to illustrate the history of this, any more than of the former monument.

The next monument described is *Dumha na m-ban-amus*, or the Mound of the Heroines, or, literally, Women Soldiers,* which, according to the prose, was a small mound situated to the south-east of the *Teach Miodhchuarta*, and at the southern end: the verse states, more simply, that it was situated at the upper or southern extremity, and calls it the Mound of the Women who had been betrayed. This mound has disappeared, and no historical illustration of it has been found.

Proceeding now to the northern extremity of the Hall, both the prose and verse place here the *Rath*, and the *Leacht*, or Grave, of Caelchu. These are described in the prose as being near the northern head of *Long na m-ban*, and the verse states that the Grave was to its north-east, and adds that it was a heap of stones; but there is every reason to believe that it should have been written north-west, as the Irish transcribers frequently mistake the word ruip for riap. Both authorities state that this Caelchu was the great-grandson of Cormac Cas, and was one of the Eoganachts of Cashel, and the most distinguished of all the men of Munster for wisdom, and that from him the chiefs of *Ros-Teamrach* and the tribe of *Tuath-cis* at Temur were descended. He was cotemporary with the monarch Cormac Mac Art, and his son Cairbre Liffeachair. This

* For an historical evidence of the existence of female soldiers in Ireland, see p. 172.

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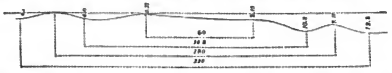
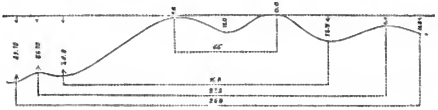
Rath and *Leacht* still remain, and the measurements of the former will be seen in the section, taken from west to east, and on a scale of 60 f. to 1 inch.



On the western side, the interior of this Rath is $5\frac{1}{2}$ f. higher than the ground on the outside, and at the eastern is 7 f. high. The *Leacht*, or Grave, is situated at the north-east side of the Rath, and is a small mound about 3 f. higher than the outer circle, which seems evidently to have been enlarged for it. This mound is of an oval form, and is 26 f. in diameter from north to south, and 20 f. from east to west at the base. It is about $6\frac{1}{2}$ f. higher than the surface of the hill, and $1\frac{1}{2}$ f. lower than the Rath.

To the north of the preceding monuments the prose account places the next feature—the *Sheskin*, or Moor, of Temur, close to *Long na m-ban*, to the north-west. This Moor has been already spoken of, and is only again noticed here to show the connexion of the contiguous monuments. Of these the first is *Rath Graine*, which, according to the prose, was situated to the west of the *Sheskin*, on the height of the hill.

Rath Graine lies on the summit of the western face of the hill, and on its abrupt slope. It appears to have had two concentric ramparts; but the external one is nearly obliterated, and a deep hollow has been excavated in the central mound, either for the purpose of obtaining gravel, or in search of treasure. Its measurements will be seen from the section, taken from east to west, and on a scale of 60 f. to 1 inch.



No historical allusion is made, either in the prose or verse, to the person from whom this fort was named, obviously because it was unnecessary, as only

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one distinguished female of the name appears in Irish history. This was Graine, the wife of the celebrated Finn Mac Cumhaill—the Fingal of Macpherson. She was a daughter of the king Cormac, with whose time almost all the monuments at Tara are identified.

The infidelity of this lady to her puissant husband is remembered traditionally in most parts of Ireland, and has been made the subject of a celebrated prose romance among the Irish, and of a poem attributed to Ossian, which has been equally current throughout Ireland and the Highlands of Scotland.

O'Flaherty, from the ancient Irish bardic histories, states, somewhat bombastically, that Cormac had a son-in-law, Finn, married to his daughter Graine, but she having eloped with Dermot, the grandson of Duibhne, he gave his other daughter, Abbea, to him in marriage. Finn was the son of Cubhal, by Mornea, daughter to the Druid Tadg, of the family of Hy-Baisgne, the descendants of Nuada the White, monarch of Ireland. He was generalissimo of the Irish militia, highly distinguished for his jurisprudence,—dissertations on which, written by him, are extant,—for his poetical compositions in his native language, and, as some write, for his prophecies. His noble military exploits have afforded a vast field of panegyric to the poets. He was reconciled to his wife, after she had, by an illicit connexion with Dermot, four sons, namely, Dunchad, Illand, Ruchlad, and Iorruadh.

The infidelity of Graine is referred to in Cormac's Glossary, under the word Ορc, and the death of Finn is thus recorded by Tighearnach:

A. D. 270. Finn h-Ua Baiscne, *decollatus* o Aicleach Mac Duibdrenn, ocus o macaib Uirgreno, oo Luaigniò Temrach, oc Athbrea for Boinn.

A. D. 270. Finn, the grandson of *Baiscne*, was beheaded by Aicleach, the son of Duibhdrenn, and by the sons of Uirgrend, of the *Luaighnians* of Temur, at *Athbrea* on the Boyne.

To the south of *Rath Graine* a smaller Rath is found, which is not noticed in the verse, but which, as it would otherwise be an unnoticed feature, there is every reason to believe must be the monument called *Fothath Ratha Graine*, and which is described as situated to the north, or in the vicinity, of *Fan na g-Carbad*, or the Slope of the Chariots, near the northern *Claenfeart* to the east. It must, however, be confessed that the description given of its situation does not appear to apply so accurately as those given of the other monuments. This Rath

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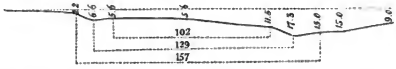
appears to have had but a single rampart and ditch, as shown on the map and section following, which is taken from south to north, and on a scale of 60 f. to an inch:



Of the other monuments, or artificial features, noticed in the ancient documents there are no distinct remains, but the localities which they occupied are so accurately described as to leave little difficulty in ascertaining them with considerable exactness.

Of these the first in the order of the prose account are the two *Claenfearts*, which are described as being situated to the west of *Rath Graine*, or, as the verse states, down to the west. Of the nature of these monuments it is now perhaps impossible to speak with any certainty, as the etymological meaning of the name, which would simply express a sloping trench, fosse, or grave, gives a very uncertain idea of their character. These localities are memorable in Irish history. The first or southern *Claenfeart* was the scene of the massacre of the young females by Dunlaing, king of Leinster, in the year 222, as recorded in the Annals of Tighearnach, and already given in page 36 of this memoir. O'Flaherty, p. 335, calls this *Claenfeart* a *Gynæceum;* and Lynch, in his very learned work, entitled *Cambrensis Eversus*, p. 70, gives as his opinion that the young females, who were of royal birth, were vestal virgins, who were at Tara as if in a *Parthenion*. "Ausus est Rex Lageniæ Dunlingus Endæi Niadi filius triginta regias virgines, quarum singulis, triginta virgines aliæ famulabantur, Temoræ Clonfartam [Claenfeartam, *recte*] tanquam Parthenion incolentes internecioni dare."

The northern *Claenfeart*, as the verse states, was memorable as the place of the treacherous covenant, and, according to the prose, as the place where Lughaidh Mac Con, the predecessor of Cormac, pronounced the false judgment, concerning the grass of the green field which was eaten by the sheep. The account of this judgment, as given in the *Leabhar Gabhala*, or Book of Conquests, compiled from ancient documents by the O'Clerys, is as follows:

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Ꝺaḃaiſ Ꝛucchaiḋ, ꝺaſ b'ainm Mac Con, an ſiꝺhe ſſi ſe ſſiochaꝛ bliaꝺan. Ꝺa iſ in bliaꝺain ꝺeiꝺeiaiġ ꝺia ſiꝺhe ſo eliġ, ocuſ ſo aiṫċeoiḋ, Coſbmac Ua Cuinn an ꝺi bſeiṫ oiſſꝺeſca imon Riġ Ꝛuġaiḋ. Feachꝛ ꝺia m-baoi mac an ſeachꝛaiſe, baoi la Mac Con hi Ꝛeamſaiġ an ionbaiḋ ſin, aſ a baoiṫ-ſeim baoiſi, ocuſ ſeabſaiḋ, con ꝺo ſála ꝺo aſoile each co m-bſiġ ocuſ boſſa,bai la h-oꝺlaeċ n-amſa hi Ꝛeamſaiġ. Ꝺo ṫaeꝛ an mac ꝺan anacal ꝺan imꝺeaꝺail ſo iaſṫaſ an eich. Ꝺoſ ſoꝺaiḃ ſi a coiſ, ocuſ ꝺo beſꝛ ſſeib n-ꝺo, ꝺuſ bo maſḃ ꝺan anmain ſo ceꝺoiſ. Cuinꝺiḋ an ſechꝛaiſe eſaic a meic; bſeaꝛha an cuinꝺiḋ ꝺuſ an ſiġ. Aꝛieꝛ bſeaꝛha no coicceſꝛa[1] aꝺ ſioꝺaib Eſenn ꝺo ſin, "Ꝺach ſoſ[2] ina chionaiḋ." Rucc Ꝛuꝺaiḋ an m-bſeiṫ ꝺ-ceꝛna, .i. an ceṫſamaḋ coſ, ꝺia ſo buaileḋ mac an ſechꝛaiſe, ꝺo bein ꝺon eoch. Ꝺaoi ꝺin Coſbmac Ua Cuinn occa leaſuġaḋ ſo ḋicleiṫ la a chaiſoiḃ, áſ ní lámṫa la Mac Con a beiṫ oſ áiſo in n-Eiſinn, o ſo hoſꝛaḋ a aṫaiſ laiſ i ꝺ-caṫ Muiꝺhe Muicſiomha, ſechꝛ ſiaṁ. Ꝺo ſala ꝺo ꝺon ċuſ ſin a beiṫ oc ionġaiſe chaeſach (ꝺia ꝺiamluġaḋ[3]) la bainꝛeabṫaiġ baoi i n-ꝺaſṡoccuſ ꝺo Ꝛhemſaiġ; ocuſ oꝛ chuala an m-bſeiṫ iſin ſo eliġ í, ocuſ aꝛ beſꝛ naſ bo cionꝛaiġe an choſ ꝺia ſo buaileaḋ an mac ol ꝺ-ꝛáꝛ na ꝛeoſa coſa oile baꝛaſ occ iomṡulanꝺ an eich an oiſeꝺ ſin. Ꝺaoi beꝺſ ſeſ-ꝺuſꝛ ꝺaḃala laſ an ſiġ i Ꝛemſaiġ; ſo eſṡuaꝺaiſſiḋe ꝺan ꝛaiſeaꝺ naċ anmanna ſo ꝺebṫa ann. Ꝛeacoṁnacaiſ co ſoſ leicc an ꝛi Coſbmac caeiſe Caoiniġe, .i.

Lughaidh, surnamed Mac Con, had the sovereignty for a period of thirty years. It was in the last year of his reign that Cormac O'Cuinn questioned, and impugned, the two famous decisions of King Lughaidh. On a time that the son of the *reachtaire*, who was with Mac Con at Temur at that time, was running about in wantonness, and youthful folly, he went [among other places] to [where stood] a steed full of strength and spirits, which belonged to a noble youth at Tara. The boy went without defence or protection between the hind legs of the steed. The steed raised his leg, and gave him a kick, of which he died immediately. The *reachtaire* demanded *eric* for his son; the demand is brought before the king. The judgments which the kings of Ireland had hitherto pronounced were conformable to a rule which says, "Every transgressor for his transgression." (That is, the person, or animal, or thing, who committed a trespass, was to be given to the sufferer in satisfaction.) Lughaidh pronounced the same judgment, namely, that the fourth leg, by which the son of the *reachtaire* was struck, should be cut off the steed. Cormac O'Cuinn was at that time receiving education in disguise with his friends, for Mac Con would not allow him to be at large in Ireland, since he (Mac Con) killed his (Cormac's) father at the battle of *Magh Muicriomha*, some time previously. He (Cormac) happened at this time to be minding sheep (by way of disguise) belonging to a widow who lived near Temur; and when he heard that judgment he impugned it, and said that the leg which struck the boy was not more guilty than the other three legs which supported the steed at the time. The king had also a grassy field (paddock) at

[1] "Coicceſꝛ .i. bſeiṫeaṁnaſ."—*O'Clery.*

[2] See Cormac's Glossary *in voce*, Moꝺene, where it is stated that this law also prevailed in Britain.

[3] "Ꝺiaṁluġaḋ .i. ꝺi-aiṫniuġaḋ no ꝺoſċuġaꝺ," disguise or disguising.—*O'Clery.*

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na bainfeadbéaġe ip in ġlaṁin, ocuṗ ṗoṁ baoi ferṁin ina ḟuiḃe occa b-ṗaiṁceṁn. Ruccṗaṫ coṁṁeoaiḃe na cluana ṗoṗṗa, ocuṗ ṗoṁ beaṗaṫ leo. Do ṫeachaiṁ Caeineach ṫo cẖuingeó na g-caeṗach ġuṗ an ṗiġ co ḃuġ. Cuṗ ṗo acaoiṁ a h-eccuiṁneaċ ṗiaḃa. Ar beṗc an ṗí co ṗo éuiṫeaṫ ina g-cionaiḋ. Ro baoi Coṗṗmac occ eiṫeeċc ṗṁiṁ in ṗiġ alla muiġ o'upṗaṁṁ an ṗiġ-éiġe, ocuṗ ar beṗc ba ġu-bṗeaṫ an coiccṫe, ooiġ ṗoḃa loṁ loṁṗaoḋ na ccaeṗaċ i loṁṗa na cluana, uaiṁ ár ṫaiṫe oiḃliṁiḋ. Or cuala Mac Con an m-bṗeiṫ occa h-eiṁġaḋ, a ṁuḋċaċ, ro aeċ ṗeaċa, conuṗ ṗaca an macaoiṁ óg, a ṁuḋċaċ, ocuṗ ar ċṁi ṗoṙg ṗiġ ina ċṁo, ocuṗ oo ṗaṫ aiṫne ġuṗ bo he an mac éaiṁṁġeaṗaċ Coṁbmac baoi ann. Ro loṁnaiġeaḋ ime, ocuṗ aeṗaiġ la ṗiuċaḋ ḟuaṁaṡóiḋ ṗeṗġe i lenmuin an ṗiġ-ṁeic. Imṫaoi-ṗṫoiṁ ṗeiṁe ṗoṁ a ioṁġaḃaṁ. Ġebiḋ an ṗiġ aġa éoġṁaiṁ co oiġṁaiṁ ooṫoċcaeċ, ġuṁ ṗoṁ cuiṁ ṗo eṁi hi ṫiṁcheall na Temṗaċ é; ocuṗ, ó na ḟuaiṁ ṗiġe eaṁ ooṗuiṁ beuṫ na Teaṁṗaiḋ amaċ, ṗo ling eaṁ cṫaoḃ an muiṁ. Ro ṫaiṫġuiṁ an muiṁ ocuṗ an ṗaeḃ, alla éiaṁ, uaiṁ ba ip in eaṁ ṁ ṗo baoi muṁ na Temṗaċ aġa aeṫnuaóuġaiḋ la Mac Con. Aċṫe ṗuiḷa an macaoiṁ uaiḋ ġan eaṁṗaċeaiṁ, conuṗ aiṗe ṁ ṗo h-aiṁṁneaṫ Claonaiḋ Teaṁṗaċ ṗoṁ Mhac Con; ocuṗ ar oe béiṁ aṁ ṗeṁaiṁṗe la ġué ġubṗeé conceṗeuṁ in Eiṁiṁ, co g-claonṗaiḋ Teaṁáiṁ ṗṁa. Ċuġaiḋ eṁa ó oo oeaċaiḋ an ṗoeṁ-macaoiṁ uaiḋ ġan muuuġaḋ ṗo ḃion oo ḃoiṁeṁaiṁ, ooiġ ṗo aiéiṁ co o-ṫaiṁic a ṗeiṁeaṁ uaṁ Éṁiṁ, ocuṗ ṗo accoḃaiṁ ouḷ ona aeḋaṁoa oon Mhuṁain. Conaċ iaṁoṁ ṗo h-ionnaṁḃuiḋ a Teaṁṗaiġ la Coṁbmac coṁa ṗoċṁaiṫeaṫ, co o-ṫoṁċaiṁ la ṗṁaoiḋ Oiḷiḷla Oluiṁ in Aṁo Feiṁiṁ ip in Mumaiṁ, iaṁ n-a ġeoġuiṁ oo ṡiaṁaiḷ neiṁe an Oiḷiḷla ceeṁa Temur; and he gave warning that there would be no restitution of any animals captured in it. It happened that Cormac allowed the sheep of *Caeinech*, i. e. of the widow, to go into the *little green*, and he himself sat to watch them. The caretakers of the green caught them, and took them with them. *Caeineach* went to King Lughaidh to request him to restore her the sheep, and complained to him of her destitution. The king said they were forfeited for their trespass. Cormac was listening to the king outside the door-post of the royal house, and he said that the sentence was a false judgment, for that the fleeces of the sheep were sufficient payment for the fleece of the green, for they both grow. When Mac Con heard the judgment impugned, he looked to one side, and perceived a beautiful, beardless youth, and perceiving a royal eye in his head, he recognized in him the prophesied son Cormac. He became wroth at the sight, and rushed with rage and impetuosity in pursuit of the royal youth. He fled before him to escape from him. The king proceeds to pursue him with vigour and fury, until he drove him three times around Temur; and, as he found no passage out at the door-way of Temur, he sprang over the mound of the *Mur*. He knocked down the *Mur* and the *Rath*, on the western side, for at that time Temur was being renewed by Mac Con. However the youth escaped from him without being caught, so that for that reason Mac Con was called *Claonadh Teamrach* (violator of *Temur*); and hence also the old saying whenever a false judgment was pronounced in Ireland, that it violates Temur. When Lughaidh saw that the noble youth escaped from him without being killed he was filled with melancholy, for he perceived that his reign over Ireland was at an end, and he desired to return to his patrimony in Munster. He was afterwards expelled from Temur by Cormac with his hosts, so that he was afterwards slain by the Druid of Oilioll Olum at *Ard-Feirchis* in Munster, having

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aeḃaiḋ ria ran ean rin. Aoir ooṁain 5424; aoir Chriorc 225.

been sometime before wounded by the venemous tooth of the Oilioll aforesaid. The age of the world [at this time] 5424; the age of Christ 225.

The same legend is related, but more briefly, in the Book of Ballymote—fol. 142—but the name of the female is written Beannaid, very probably through an error of the transcriber. The passage is, however, worth adducing, as it attempts to account for the name Claenfeart, and indicates that it was a building.

ḋai ban-ḃrugaiḋ a Temraiġ in innsiḋ rin, .i. Beannaiḋ. Luṫar a caiṙiġ-ṙe co n-uaṫaiḃ glaiṙm na riġna. Derar in riar co Lugaiḋ. Ar ṙeṙc ṙe na caiṙiġ in ic na glaiṙne oon riġaiḃ. Asc, ol Cormac. Leor lomraḋ na caeraiḋ a lomraḋ na glaiṙne, ar raiṫe oiḃlinaiḃ. Ir i in ḟir-ḃreiṫ, ar eaḋ, ir e mac na ḟir ḟlaiṫa ruc in ḃreiṫ. Cuiṫ ro naill leiṫ oon eiṫ i rucaḋ in gaiṫ ḃreiṫ meraiḋ raṁlaiḋ eu braiṫ; comio rin Claenfearta Temraiḋ.

There was a female *brughaidh* at Temur at that time, i. e. *Beannaid*. Her sheep went and eat the queen's *glaisin*. The case was brought before Lughaidh. He said that the sheep were forfeited to the queen for the *glaisin*. I deny it said Cormac. The fleece of the sheep is sufficient for the fleece of the *glaisin*, for both are of equal length. That is the true judgment, said all, and he is the son of the true king who has pronounced the judgment. The side of the house in which the false sentence was pronounced *leaned to one side*, and it will remain so for ever; and hence the *Claenfearta* of Temur.

The next feature noticed is that called *Fan na Carbad*, or the Slope of the Chariots, which is described in the prose as being situated near the Northern Claenfeart to the east, and in the verse as between the Cross of Fergus and the Claenfearts. This topographical feature still exists, and will be noticed more particularly in connexion with the other ancient roads diverging from Tara. The Cross here alluded to does not remain, but its locality can be fixed with nearly perfect certainty. To the holy pilgrim Fergus, who gave name to this Cross, no historical allusion has been found.

To the north of the *Sheskin*, or Moor, of Tara, were situated two cairns, or monumental heaps of stones, one called the Cairn of the Leinster Youths, and the other the Cairn of the Hy-Niall Youths. These cairns were situated north and south of each other, and between them lay the *Deisiol Temrach*, which is spoken of in the verse as a lucky spot before going to heaven, where people turned to the right, or sun-ways. This notice has evidently a reference to the

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ancient pagan superstition of the Irish, not yet obsolete, that making a circle sun-ways was productive of prosperity, or good fortune. This custom is still observed in the Roman Catholic pilgrimages, burials, &c.

Martin, in his description of the Western Isles, gives many instances of this superstition. On his visiting the Island Rona, he says, "One of the natives would needs express his high esteem for my person, by making a turn round about me Sun-ways, and at the same time blessing me, and wishing me all happiness; but I bid him let alone that piece of homage, telling him I was sensible of his good meaning towards me: but this poor man was not a little disappointed, as were also his neighbours; for they doubted not but this antient ceremony would have been very acceptable to me: and one of them told me, That this was a thing due to my character from them, as to their chief and patron, and they could not, nor would not fail to perform it."—p. 20.

This custom still exists in many parts of Ireland, and a turning to the opposite or left side, is considered as unlucky. Hence the common Irish phrase, expressive of ill-will, "Iompóḋ air mór thuathal chugat," i. e. a full turn to the left to you."

From this custom the seat of the chief of the Maguires, in the county of Fermanagh, received its name *Tempo Deisiol*, now shortened into Tempo; and there was also an ancient locality in Derry, called the *Deisiol.*

The antiquity of this pagan usage is so satisfactorily shewn by Toland, in the following passage of his Critical History of the Celtic Religion,—p. 142, *et seq.* —as to preclude the necessity of further illustration:—

"The vulgar in the Ilands do still show a great respect for the *Druid's Houses*, and never come to the antient sacrificing and fire-hallowing *Carns*, but they walk three times round them from east to west, according to the course of the Sun. This sanctified tour or round by the south, is call'd *Deiseal*;* as the unhallow'd contrary one by the north, *Tuapholl.*† But the Irish and Albanian Scots do not derive the first, as a certain friend of mine imagined, from *Di-sul*, which signifies *Sunday* in Armorican British, as *Dydh-syl* in the Welsh and *De-zil* in Cornish do the same; but from *Deas*,‡ the right, understanding *hand*, and *Soil*, one of the antient names of the Sun, the right hand in

* Dextrorsum. † Sinistrorsum. ‡ *Item* Deis.

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this round being ever next the heap. The Protestants in the Hebrides are almost as much addicted to the *Deisiol*, as the Papists. Hereby it may be seen, how hard it is to eradicate inveterate Superstition. This custom was us'd three thousand years ago, and God knows how long before, by their ancestors the antient Gauls of the same religion with them; who *turn'd round right-hand-wise, when they worship'd their Gods*, as ATHENEUS* informs us out of POSIDONIUS a much elder writer. Nor is this contradicted, but clearly confirm'd by PLINY, who says, *that the Gauls, contrary to the custom of the Romans,† turn'd to the left in their religious ceremonies;* for as they begun their worship towards the east, so they turn'd about, as our Ilanders do now, from east to west according to the course of the Sun, that is, from right to left, as PLINY has observ'd; whereas the left was among the Romans reputed the right in Augury, and in all devotions answering it. Nor were their neighbors, the Aboriginal Italians, most of 'em of Gallic descent, strangers to this custom of worshipping right-hand-wise, which, not to allege more Passages, may be seen by this one in the *Curculio*‡ of PLAUTUS, who was himself one of them: *when you worship the Gods, do it turning to the right hand;* which answers to turning from the west to the east. It is perhaps from this respectful turning from east to west, that we retain the custom of drinking over the left thumb, or, as others express it, according to the course of the Sun; the breaking of which order, is reckoned no small impropriety, if not a downright indecency, in Great Britain and Ireland. And no wonder, since this, if you have faith in HOMER, was the custom of the Gods themselves. VULCAN, in the first book of the *Iliad*,§ filling a bumper to his mother JUNO,

> To th' other Gods, going round from right to left,
> Skenk'd Nectar sweet, which from full flask he pour'd."

To the north-east of the *Carn* of the *Hy-Niall* youths, that is the northern Carn, according to the prose, was situated the Rath of Colman, the son of Cael-

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* Ουτω θεους προσκυνουσιν, επι τα δεξια στρεφομενοι.—*Lib.* 4. p. 152.

† In adorando dexteram ad osculum referimus, totumque corpus circumagimus; quod in laevum fecisse Galli religiosius credunt. *Hist. Nat. lib.* 28. *cap.* 2.

‡ Si Deos salutas, dextrovorsum censeo. *Act.* 1. *Scen.* 1. *ver.* 70.

§ Λυταρ ὁ τους αλλοισι θοως ενδεξια πασιν
Ωνοχοει, γλυκυ νεκταρ απο κρητηρος αφυσσων.—*Il.* 1. *ver.* 597.

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chu. It will be recollected that this Caelchu—whose Rath and sepulchre, situated to the west of the hall, have been already described—was the hostage of the people of Munster, in the time of Cormac, and that he left after him at Tara a family, who became the chiefs of *Ros-Teamrach*, and of the tribe of *Tuath-cis*.

The same authority places the Mound of Luchdonn beside the Rath of Colman, to the west. Of this Luchdonn no historical notice has been found.

To the south-east of the Rath of Colman, beside the *Leitir*, or slope of the hill, the prose places the two Wells, called *Adhlaic* and *Diadhlaic*, which according to the verse flowed down to *Cairn na Macraidhe*, or the Carns of the Youths. These natural features have escaped total destruction, although an attempt to obliterate one of them was lately made. In the year 1837 this one was covered over, and, though there is still a strong flow of water at its site, it is no longer an open well. Up to this period these wells had been considered holy, and one of them was popularly called St. Patrick's Well; about a rood of ground around them had till that time been lay-ground, and kept in that state from a supposition that it had been a burial ground in ancient times, and it is highly probable that this belief was founded in fact. From a record in the Annals of Ulster, it would appear certain that there was a church or ecclesiastical establishment at Tara as early as the fifth century, as it records, at the year 503, the death of a Bishop Cerpan, or Cerban, of *Fearti Cherpain* at Tara:—"*Cerpan mortuus est—Eps.* o Ꞵeaꞃti Cheꞃꝑaiꞃ oc Ꞇemuiꞃ." Tighearnach also records the death of Cerban, bishop of *Ferta Cerbain*, at the year 504, the true year—but without naming Tara; and the Annals of the Four Masters have an entry similar to that in the Annals of Ulster, but which is wholly in Irish, and erroneously placed at the year 499.

It would appear that this Bishop Cerpan was a convert made by St. Patrick on his memorable visit to Tara in the reign of Laogaire, as it is stated in a passage in the annotations of Tirechan, already quoted, p. 167,—that on this occasion he wrote elements, that is, an alphabet, for Cerpanus.

From the identification of these wells the greatest facility is afforded in discovering the situation in which the remaining monuments were located.

The *Tredumha*, or Triple Mound of Nesi, the daughter of Eochaidh Salbhuidhe, the mother of Conchobhar Mac Nesa, according to the prose, was at the north-eastern end of *Long na m-ban*, or the Banqueting Hall.

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According to the same authority the Rath of Conchobhar Mac Nesa was situated beside the *Tredumha* to the north, with its door facing the *Ceann* and *Medhi*, or Head and Neck of Cuchullin. Near the *Medhi* were the ruins of the *Sciath** *Chonchulainn*, or Shield of Cuchullin, with its *Tull*, or hollow. The Rath, it adds, was level with the ground, and there was a small hillock in its centre, with as much of his clay, or ashes, in it as would fill the hollow of his shield.† The verse places all these monuments to the east of the *Sheskin*, or Moor, and adds another, omitted in the prose, namely, the Grave and Monument of Mal and Midna.

Of the persons to whom the preceding monuments referred, there is little or nothing to be found in history, with the exception of Conchobhar or Conor Mac Nesa, king of Emania, or Ulster, and his cotemporary the celebrated hero Cuchullin. Tighearnach places the death of the first as occurring in the eighth year of the reign of the Emperor Tiberius, or the twenty-second of the Christian Era. His mother Nesi, from whom the adjacent *Tredumha*, or triple mound, was named, is stated by the same authority to have been the wife of Cathbad the Druid, and to have borne him adulterously; she is the subject of many revolting legendary Irish stories.

The death of the hero Cuchullin is thus recorded by Tighearnach at the year 2.

A. D. 2. *Mors* Concullainn *fortissimi herois Scotorum*, la Lugaid Mac na Eri Con, ocus la h-Erc Mac Cairbre Niafer; *vii.* m-bliadain a aer in uair do gab gaisced; *xvii.* in can bai a n-oiaid cana bo Cuailgne, *xxvii.* an can ro bath.

A. D. 2. The death of Cucullainn, the bravest hero of the Scots, by Lughaidh Mac-na-tri-Con, and by Erc, the son of Cairbre Niafer; seven years his age when he was initiated into the military order; seventeen when he pursued the cattle spoil of Cuailgne, and twenty-seven when he was killed.

The plunder of Cuailgne, the country to the north of Dundalk where Cuchullin resided and where his Rath still remains, formed the subject of a romance called *Tain bo Cuailgne*, or the cattle spoil of Cuailgne, which is probably one

* This would appear to have been a mound of earth resembling a shield.

† Can in rela do hurp. The meaning of these words in the prose account was not discovered when the sheet was printed.

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of the most ancient in the language; a copy of it is preserved in the *Leabhar na h-Uidhre.*

The notices of the monuments in Tara, called Cuchullin's Head, and Neck, would be very obscure but for the discovery of the following passage in the Book of Glendalough, giving an account of his death, from which it appears that these were monuments or mounds covering his divided remains.

Iar sin asa do rochair a clandem allaim Conculainn, co n-ecmoing a laim dos di Luigdi, cor boibi for lar. Denair a lam dos dan di Coinculainn ota oirgni. Do cumlat ar iarm in s-sluag, ocus do berat leo cenn Conculainn ocus a laim dos di cancatar Temair, conid ano ata adaltige a ano ocus a laime dói, ocus lam laimne a sceti di sir; conid de ar berte Senchatach Mac Aililla in aidedaib Ulad.

After that then the sword fell from the hand of Cuchullin, so that it struck off the right hand of Lughaidh, which fell to the ground. But in revenge his right hand was cut off Cuchullin also. The host then moved away from the place, and carried with them the head and right hand of Cuchullin until they reached Temur, where the burial place of his head and right hand is, and the full of the hollow of his shield of his clay; of this Kenfaela the son of Ailill spoke in his account of the deaths of the Ultonians.

Do cer Cuculainn, cain cuir,
Sren-fer in n-Airbiu ro fir;
Reraig buidne ba mo clid
Fri mac sri Con, fri Luigdig.
Cin coo rochair ferca n-glé;
Nir bo duitem mislaige.
Ceithri octhair, ceithri deic,
Ceithri coicait, cain in sreith,
Ceithri cethrachait, coicat rim,
Ceithri ceithrachait, cruaid gnim,
Ceithri trichit fri feib,
Forroichid Mac Suailtin.
Ro gaid in adguba
Trichat rig oi erchraib,
Im sith. sichiu anemne,
For n-acaib oiferbaidib.
Ata senn conair do
Dron eirr in ochtar Temro;
Uaigthe iarom a forcetl
D'airrchi Cairrpe Niafer.
Ata senn Echaid inniu
Irrid Nemta iar Urciu;

After that then the sword fell from the hand of Cuchullin, so that it struck off the right hand of Lughaidh, which fell to the ground. But in revenge his right hand was cut off Cuchullin also. The host then moved away from the place, and carried with them the head and right hand of Cuchullin until they reached Temur, where the burial place of his head and right hand is, and the full of the hollow of his shield of his clay; of this Kenfaela the son of Ailill spoke in his account of the deaths of the Ultonians.

Cuchullin, the beauteous tower fell,
The mighty man at Airbiu truly;
Hosts of fame went forth
With Lughaidh, the son of the three Cons.
The manly beauteous champion fell;
It was not the fall of a dastard.
Four times eight, four times ten,
Four times fifty, comely chiefs,
Four times thirty, proud the number,
Four times forty, great the deed,
Four times twenty men of might,
Were slain by the son of Suailtin.
He wounded in affliction
Thirty kings with his javelins,
Besides seven score champions,
Whom he left in agony.
There is a monument for his head
On the ridge at the upper part of Temur;
Buried subsequently was his forehead
With the neck of Cairbre Niafer.
The head of Eochaidh is to-day
At *Sidh Neanta* at *Uisciu;*

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Uaiȝée cenn Coppre cain ri,	Buried was the head of Cairbre the just king,
Do aipreiu Echoach i Teébai.	With the neck of Eochaidh in Teffia.

The origin of the monument, or, perhaps, monuments, of Mal and Miodna, has been ascertained from an ancient Irish romantic tale called *Dearg-Ruathar Chonaill Cearnaigh*, or, the Bloody Rout of Connell Cearnach, a tale usually appended to the popular romance, called *Brisleac Mor Muighe Muirtheimne*, or the Great Breach of the Plain of Muirtheimne, which was the ancient name of the level country on either side of Dundalk. It is stated in this tale that, at the time when Cuchullin was slain and beheaded in the battle of Muirtheimne—his cousin, the celebrated Connell Cearnach, being "beyond the sea"—the wife of Cuchullin, Eimer, sent Lavareaim, the slender-waisted, the female messenger of the heroes of the Red Branch, to discover where he was, and acquaint him with the death of her husband, in order that he should return to revenge it, as he was bound to do by a previous agreement. It happened that Lavareaim, on coming to the sea-shore at Invermore, near Dundalk, descried and recognised the ship of Connell, named the *Eangach*, approaching to the shore; and, on his landing, she acquainted him with the subject of her message, which Connell heard with the deepest sorrow, and immediately resolved to discover who of the men of Ireland had slain him, that he might wreak his vengeance on them. Accordingly, having got his *carbad*, or chariot, ready, he drove at once to the plain of Muirtheimne, where he found the headless body of Cuchullin, over which he wept, and recited a dirge in which he expressed his sorrow, extolled the valour of his companion and foster-son, and repeated his determination to revenge his untimely death. He afterwards proceeded to Tara, where he found Mal and Miodna, two of the chiefs of Erc, the Irish monarch, engaged at the game of hurling, their ball being a human head! "What is this you are hurling?" inquired Connell. "Did you not hear," it was answered, "of the death of Cuchullin by the men of Ireland, and do you not know that this is his head?" "I did," replied Connell, uttering an exclamation of grief, "and you shall be headless for treating his head with such indignity;" on which he slew and beheaded both.

The tale, from which the preceding notice has been obtained, is one of a very numerous class of romantic stories, partly historical and partly fabulous—but certainly anterior in age to the tenth century—which are still preserved in

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the Book of Glendalough, *Leabhar na h-Uidhre*, and other ancient vellum MSS., and are all well worthy of translation, no less as specimens of the popular literature of their times, than as illustrations of the ancient manners, customs, and topography of Ireland. They are all in prose, but contain lyrical pieces, introduced to relieve the monotony of recitation; and there is no doubt that, as stated in the MSS., they were recited and sung at public entertainments—being, as Mr. O'Flanagan well remarks, the substitutes of the Irish for the dramatic entertainments of Greece and Rome. A specimen of these romantic tales, very accurately translated by Mr. O'Flanagan, will be found in the Transactions of the Gælic Society of Dublin, 1808. It is entitled "Deirdri, or the Lamentable Fate of the Sons of *Usnach*."

The only ancient topographical features of Tara Hill, which now remain to be noticed, are the ancient roads which led to it from the different provinces of Ireland. These roads are not described in the ancient documents hitherto used, but notices of them occur frequently in Irish histories, and their number, names, and historic origins, are stated in the same topographical tract—the Dinnseanchus—from which the accounts of the monuments of Tara already given have been chiefly derived. They are thus enumerated by O'Flaherty, in his account of the reign of Conn of the Hundred Battles, on the night of whose birth they are recorded to have been found, or perhaps made; and who, according to O'Flaherty's chronology, ascended the throne of Temur in the year 177.—"Quinque viæ Temoriam versus, quæ Quinto rege nascente fuerunt, ut aiunt, detectæ, hæ memorantur; Slighe-asuil, Slighe-midhluachra, Slighe-cualann, Slighe-mhor, ubi Eskir-rieda se obviam offert, et Slighe-dhala. — *Ogygia*, p. 314.

The original account of these roads, as given in the Dinnseanchus, is as follows. *Book of Leacan*, f. 239, p. *b*, col. 1:

Coic ꝑꝑim.ꝓoiꞇ Eꝛenn, .i. Sligi Dala, ocuꞅ Sligi Aꞅail, ocuꞅ Sligi Midluaćꝛa, ocuꞅ Sligi Chualann, Sligi Moꝛ.

Sligi Aꞅail cheadamuꞅ ꝓuꞅ ꝼuaiꝛ Aꞅal, mac Doiꝛdomblaiꞅ ꝓia n-dibeaꝛgachaib Midi, ac toꝛoćtain co Temꝛaid.

Sligi Midluachꝛa don ꝼoꞅ ꝼuaiꝛ Midluachaiꝛ mac Damaiꝛne mac Duipaltaich

The five principal roads of Ireland, viz., *Sligi Dala*, and *Sligi Asail*, and *Sligi Midluachra*, and *Sligi Cualann*, [and] *Sligi Mor*.

First, of *Sligi Asail*, which was discovered by Asal, the son of Dordomblas, before the plunderers of Meath, in going to Teamur.

Sligi Midluachra was discovered by Midluachair, the son of Damairne, son of Dupaltach, son of

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mac rig Sruibe Broin ic eroṡċeam co fer Temrach

Sligi Chualann ro fuair Fingin, mac Eogabail, ria Mesċuirib Sidi, ac roṫain Temrach.

Sligi Dala ror fuair Setna, ferc-derg, mac Durbaiṫi, ria n-draoiḃ Irmuman, ac raiṁ Theamrach; no ir Dala fodeirin ror airneċe do.

Sligi Mor .i. Escir Riada, rṫe comroinn na h-Erinn inḋe, .i. o Aṫeliaṫ Cualann co h-Aṫeliaṫ Meadraiḋi, ror fuair Nar, mac Oengusa Umaill ria laṫaiḃ gaile Iṙrus Domnann ac imṫorṁom eṫoraiṫ conid iad ṫoiṫiṫ do rigṫe Temrach.

Droċe gene Cuinn era ro fried na roiṫred, umaill ar beare Airni Fingin mac Luċṫa.

the king of *Srub Broin*, at his going to the *fes* of Teamur.

Sligi Cualann was discovered by Fingin, the son of Eogabail, before Meschuirib of *Sidi*, on going to Teamur.

Sligi Dala was discovered by Setna Serc-derg, the son of Durbaide, before the Druids of *Irmumhain*, on their way to Teamur; or it was Dala himself that watched for him.

Sligi Mor, i. e. *Escir Riada*, which divides Ireland equally, i. e. from *Aṫeliaṫ Cualann* to *Aṫeliaṫ Meadhraidhe*, which was discovered by Nar, the son of Ængus of Umhaill, before the warriors of Iorrus Domhnann, keeping leadership, that they might be the first who would reach Teamur.

On the night of the birth of Conn these roads were discovered, as was sung by Airni Fingin, son of Luchta.

As the poem which follows in the original merely states the same facts, it is unnecessary to adduce it here.

Of some of these roads very indistinct traces now remain, but their localities are still remembered by the old inhabitants, though their ancient names, as well as those of other features at Tara, are unfortunately forgotten. And it is consequently impossible to fix with certainty the original names of some of these roads, or to trace their directions, till more distinct evidences are obtained from ancient sources. The roads which have been ascertained with the greatest apparent certainty are those called the *Slighe mor*, or great road, and the *Slighe Cualann*, or road to Wicklow, through Dublin, though the junctions of these roads with Tara are in both instances obliterated, and now only remembered traditionally. The *Slighe mor*, as marked on the ancient map, struck off from the *Fan na g-carbad*, or Slope of the Chariots, at the northern head of the Hall, and joined the Escir Riada, or great Connaught road from Dublin *via* Trim: the *Slighe Cualann* struck off from the *Fan na g-carbad*, or, perhaps more correctly, the *Slighe Miodhluachra*, near the present village, and led to Dublin *via* Ratoath. The *Slighe Miodhluachra*, as appears from various notices in ancient documents, was the north-eastern road from Tara,

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and apparently proceeded in the direction of Duleek and Drogheda. There is, therefore, every reason to believe that the road still pointing in that direction is, to a certain distance at least, identical with that ancient road. The *Slighe Dala* led from the southern side of the hill in the direction of Ossory and East Munster, and it is most probable, that its track at its junction with Tara is still preserved in the southern road from the hill. There remains then only the *Slighe Asail*, and this, there can be little doubt, was a continuation of the ancient *Fan na g-carbad*, or Slope of the Chariots, which still remains, though little used, as it appears from a passage in the *Leabhar na h-Uidhre*, that *Fan na g-carbad* was on the line of road leading from Tara to *Brugh na Boinne*, which is situated on the Boyne to the east of Navan.

The monuments of Tara, described in the documents in the *Dinnseanchus*, have been all now illustrated; but, to make this memoir as satisfactory and complete as possible, it will be proper to include a notice of two remarkable similar monuments in its immediate vicinity, and particularly as one of them at least is of the same age, and is most intimately connected with its history. The monument here alluded to is that called *Rath Meadhbha*, or the Rath of Meve, which is situated on a height about a mile to the south-east of Tara Hill, as seen from which it is a striking object. This Rath appears to have been an inclosure with a single circular rampart, and without any ditch. A section from north to south, on a scale of 150 f. to an inch, gives the following measurements :—

The *Meadhbh*, or Meve, from whom this Rath was named, was, according to all the ancient Irish authorities, the wife of Art, the father of Cormac, as O'Flaherty thus writes, p. 324: "Mauda filia Canani de Cualann, à qua *Rathmeadhbha* Temoriæ regia nomen sumpsit, è Lagenia genus trahens, fuit Arturi regina, sed Cormaci filii genitrix non fuit. Hanc diversam à Mauda Niacorbi, et Cormaci Cucorbi regis Lageniæ filiorum matre, ut superius attigi, satis evincunt diversa tempora."

The remaining feature to be noticed is that called *Rath Miles*, which is situated about a mile from the summit of Tara Hill to the north. The measure-

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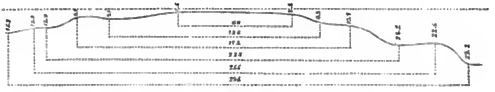
ments of this Rath will appear from the accompanying section, taken from south to north, and on a scale of 60 f. to an inch.



No historical illustration of this Rath has been discovered.

Having brought this somewhat tedious account of the ancient monuments of Tara to a conclusion, it only remains to add a few remarks. From the historical allusions adduced, it will have been seen, that with the exception of a few of those last described, they are all nearly cotemporaneous, and belong to the third century of the Christian era, a period quite within the limits of authentic Irish history. The era of the original Tuatha De Danann *Cathair* belongs to the remote period of uncertain tradition; and the only other early monuments of ascertained date are those of Conor Mac Nesa and Cuchullin, both of whom flourished in the first century.

These facts seem sufficient to prove, that before the time of Cormac Mac Art Tara had attained to no distinguished celebrity as a regal city, and sufficiently accounts for its omission in the map of Ptolemy, who wrote in the preceding century.

It will also have been seen that a uniform character pervades all these earthen works, and mark them as the monuments of one people; and this fact may go far in elucidating the history of that Scotic race, who ruled in Ireland at the period of their erection.

Of the character of the buildings, which were originally connected with these remains, it is scarcely necessary to remark, that they must obviously have been of wood and clay; and though stone houses as well as fortresses are commonly found along the northern, western, and southern coasts of Ireland, it is quite evident that, with the probable exception of the ancient Tuatha De Danann *Cathair*, nothing of the kind ever existed here. But, though the houses were unquestionably of those materials, it must not be inferred that they were altogether of a barbarous structure, or inferior in point of comfort to the cotemporaneous works

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of other nations, equally remote from examples of Grecian and Roman civilization. It is not probable that they were unlike, or inferior to those of the ancient Germans, of which Tacitus speaks in terms of praise, and which he describes as being overlaid with an earth so pure and splendid that it resembled painting. And the observation of Mr. Moore, applied to these remains, though somewhat clothed in the language of the poet, is not unworthy of a philosophical historian; that, "however scepticism may now question their architectural merits, they could boast the admiration of many a century in evidence of their grandeur. That these edifices were merely of wood is by no means conclusive, either against the elegance of their structure, or the civilization, to a certain extent, of those who erected them. It was in wood that the graceful forms of Grecian architecture first unfolded their beauties, and there is reason to believe, that at the time when Xerxes invaded Greece, most of her temples were still of this perishable material."

Note.—While this paper was passing through the Press, the wells called *Laegh* and *Cabrach Cormaic*,—the first on the western, and the second on the eastern side of the hill, and which were supposed to be obliterated,—have been discovered, and are inserted on the plan of the Antiquities, as restored from the ancient descriptions.

END OF VOLUME XVIII.

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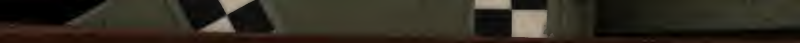

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